

RED SEAL

THE INTERPROVINCIAL STANDARDS RED SEAL PROGRAM



National Occupational Analysis

2010 | Plumber



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Skills Development Canada

Ressources humaines et
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Analyses Series**

Plumber

2010

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The Canadian Council of Directors of Apprenticeship (CCDA) recognizes this National Occupational Analysis (NOA) as the national standard for the occupation of Plumber.

Background

The first National Conference on Apprenticeship in Trades and Industries, held in Ottawa in 1952, recommended that the federal government be requested to cooperate with provincial and territorial apprenticeship committees and officials in preparing analyses of a number of skilled occupations. To this end, Human Resources and Skills Development Canada (HRSDC) sponsors a program, under the guidance of the CCDA, to develop a series of National Occupational Analyses (NOAs).

The NOAs have the following objectives:

- to describe and group the tasks performed by skilled workers;
- to identify which tasks are performed in every province and territory;
- to develop instruments for use in the preparation of Interprovincial Red Seal Examinations and curricula for training leading to the certification of skilled workers;
- to facilitate the mobility of apprentices and skilled workers in Canada; and,
- to supply employers, employees, associations, industries, training institutions and governments with analyses of occupations.

ACKNOWLEDGEMENTS

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This analysis was prepared by the Workplace Partnerships Directorate of HRSDC. The coordinating, facilitating and processing of this analysis were undertaken by employees of the NOA development team of the Trades and Apprenticeship Division. Keith Crowell for the host jurisdiction of Alberta also participated in the development of this NOA.

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**LIST OF PUBLISHED
NATIONAL OCCUPATIONAL ANALYSES
(Red Seal Trades)**

TITLE	NOC* Code
Agricultural Equipment Technician (2007)	7312
Appliance Service Technician (2005)	7332
Automotive Painter (2009)	7322
Automotive Service Technician (2009)	7321
Baker (2006)	6252
Boilermaker (2008)	7262
Bricklayer (2007)	7281
Cabinetmaker (2007)	7272
Carpenter (2010)	7271
Concrete Finisher (2006)	7282
Construction Craft Worker (2009)	7611
Construction Electrician (2008)	7241
Cook (2008)	6242
Electrical Rewind Mechanic (1999)	7333
Electronics Technician – Consumer Products (1997)	2242
Floorcovering Installer (2005)	7295
Glazier (2008)	7292
Hairstylist (2009)	6271
Heavy Duty Equipment Technician (2009)	7312
Industrial Electrician (2008)	7242
Industrial Mechanic (Millwright) (2009)	7311
Instrumentation and Control Technician (2010)	2243
Insulator (Heat and Frost) (2007)	7293
Ironworker (Generalist) (2010)	7264
Ironworker (Reinforcing) (2010)	7264
Ironworker (Structural/Ornamental) (2010)	7264
Landscape Horticulturist (2010)	2225
Lather (Interior Systems Mechanic) (2007)	7284

*National Occupational Classification

TITLE	NOC* Code
Machinist (2010)	7231
Metal Fabricator (Fitter) (2008)	7263
Mobile Crane Operator (2009)	7371
Motorcycle Mechanic (2006)	7334
Motor Vehicle Body Repairer (Metal and Paint) (2010)	7322
Oil Burner Mechanic (2006)	7331
Painter and Decorator (2007)	7294
Partsperson (2010)	1472
Plumber (2010)	7251
Powerline Technician (2009)	7244
Recreation Vehicle Service Technician (2006)	7383
Refrigeration and Air Conditioning Mechanic (2009)	7313
Rig Technician (2008)	8232
Roofer (2006)	7291
Sheet Metal Worker (2010)	7261
Sprinkler System Installer (2009)	7252
Steamfitter — Pipefitter (2010)	7252
Tilesetter (2010)	7283
Tool and Die Maker (2010)	7232
Transport Trailer Technician (2008)	7321
Truck and Transport Mechanic (2010)	7321
Welder (2009)	7265

Requests for printed copies of National Occupational Analyses may be forwarded to:

Trades and Apprenticeship Division
 Workplace Partnership Directorate
 Human Resources and Skills Development Canada
 140 Promenade du Portage, Phase IV, 5th Floor
 Gatineau, Quebec K1A 0J9

These publications can be ordered or downloaded online at: www.red-seal.ca. Links to Essential Skills Profiles for some of these trades are also available on this website.

STRUCTURE OF ANALYSIS

To facilitate understanding of the occupation, the work performed by tradespersons is divided into the following categories:

Blocks	the largest division within the analysis that is comprised of a distinct set of trade activities
Tasks	distinct actions that describe the activities within a block
Sub-Tasks	distinct actions that describe the activities within a task
Key Competencies	activities that a person should be able to do in order to be called 'competent' in the trade

The analysis also provides the following information:

Trends	changes identified that impact or will impact the trade including work practices, technological advances, and new materials and equipment
Related Components	a list of products, items, materials and other elements relevant to the block
Tools and Equipment	categories of tools and equipment used to perform all tasks in the block; these tools and equipment are listed in Appendix A
Context	information to clarify the intent and meaning of tasks
Required Knowledge	the elements of knowledge that an individual must acquire to adequately perform a task

The appendices located at the end of the analysis are described as follows:

Appendix A — Tools and Equipment	a non-exhaustive list of tools and equipment used in this trade
Appendix B — Glossary	definitions or explanations of selected technical terms used in the analysis
Appendix C — Acronyms	a list of acronyms used in the analysis with their full name
Appendix D — Block and Task Weighting	the block and task percentages submitted by each jurisdiction, and the national averages of these percentages; these national averages determine the number of questions for each block and task in the Interprovincial exam
Appendix E — Pie Chart	a graph which depicts the national percentages of exam questions assigned to blocks
Appendix F — Task Profile Chart	a chart which outlines graphically the blocks, tasks and sub-tasks of this analysis

DEVELOPMENT AND VALIDATION OF ANALYSIS

Development of Analysis

A draft analysis is developed by a committee of industry experts in the field led by a team of facilitators from HRSDC. This draft analysis breaks down all the tasks performed in the occupation and describes the knowledge and abilities required for a tradesperson to demonstrate competence in the trade.

Draft Review

The NOA development team then forwards a copy of the analysis and its translation to provincial and territorial authorities for a review of its content and structure. Their recommendations are assessed and incorporated into the analysis.

Validation and Weighting

The analysis is sent to all provinces and territories for validation and weighting. Participating jurisdictions consult with industry to validate and weight the document, examining the blocks, tasks and sub-tasks of the analysis as follows:

- | | |
|------------------|--|
| BLOCKS | Each jurisdiction assigns a percentage of questions to each block for an examination that would cover the entire trade. |
| TASKS | Each jurisdiction assigns a percentage of exam questions to each task within a block. |
| SUB-TASKS | Each jurisdiction indicates, with a YES or a NO, whether or not each sub-task is performed by skilled workers within the occupation in its jurisdiction. |

The results of this exercise are submitted to the NOA development team who then analyzes the data and incorporates it into the document. The NOA provides the individual jurisdictional validation results as well as the national averages of all responses. The national averages for block and task weighting guide the Interprovincial Red Seal Examination plan for the trade.

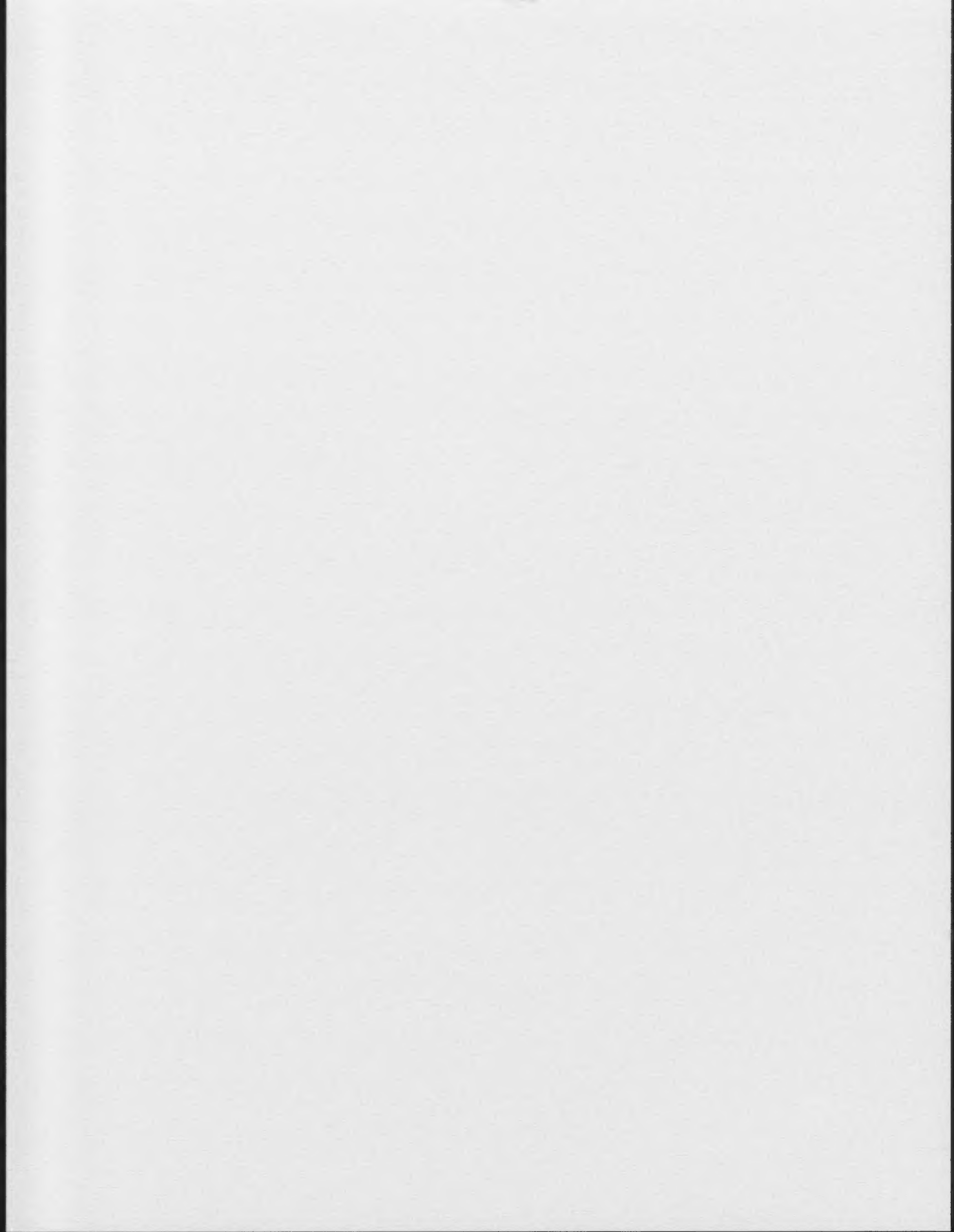
This method for the validation of the NOA also identifies common core sub-tasks across Canada for the occupation. If at least 70% of the responding jurisdictions perform a sub-task, it shall be considered common core. Interprovincial Red Seal Examinations are based on the common core sub-tasks identified through this validation process.

Definitions for Validation and Weighting

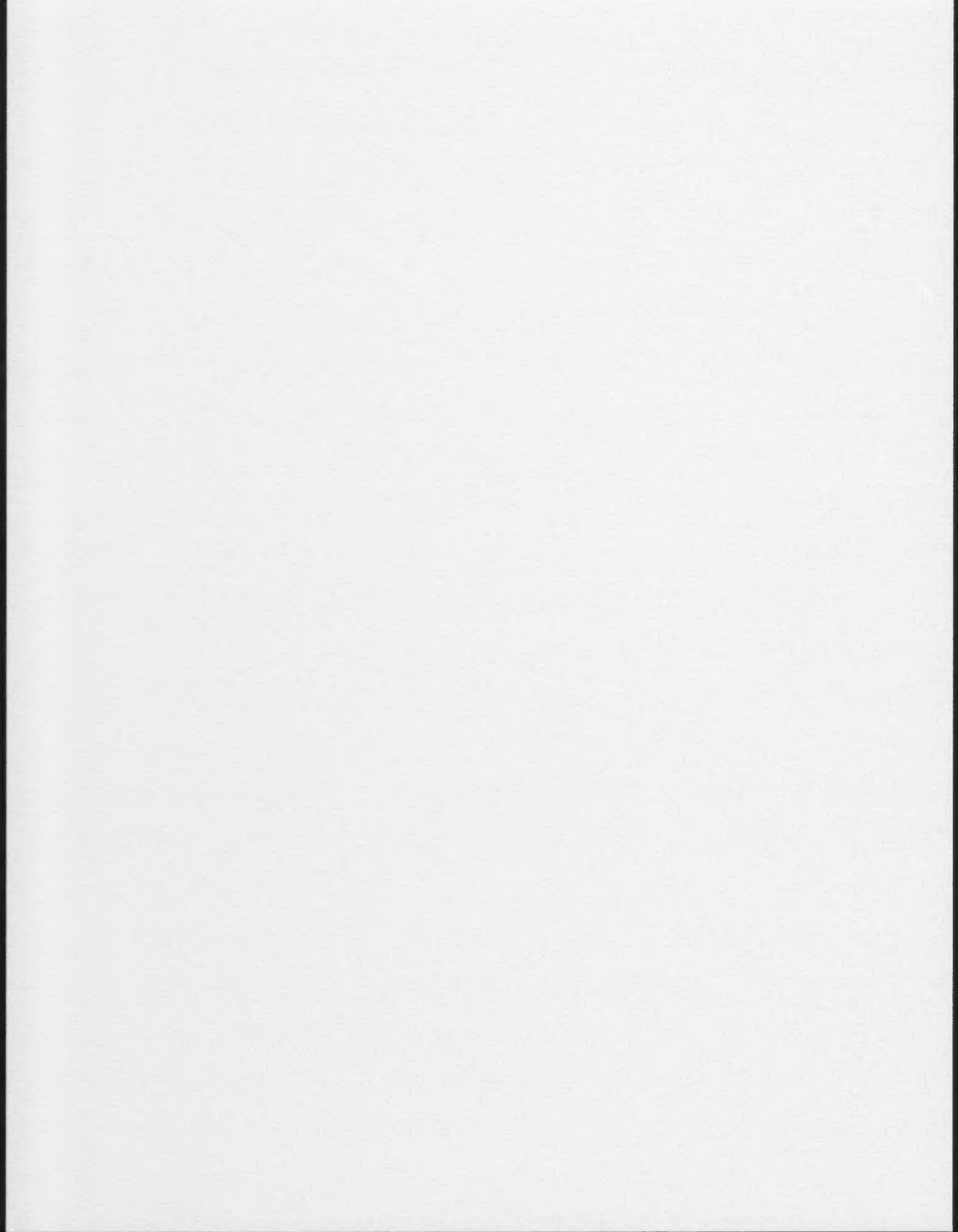
YES	sub-task performed by qualified workers in the occupation in a specific jurisdiction
NO	sub-task not performed by qualified workers in the occupation in a specific jurisdiction
NV	analysis Not Validated by a province/territory
ND	trade Not Designated in a province/territory
NOT COMMON CORE (NCC)	sub-task, task or block performed by less than 70% of responding jurisdictions; these will not be tested by the Interprovincial Red Seal Examination for the trade
NATIONAL AVERAGE %	average percentage of questions assigned to each block and task in Interprovincial Red Seal Examination for the trade

Provincial/Territorial Abbreviations

NL	Newfoundland and Labrador
NS	Nova Scotia
PE	Prince Edward Island
NB	New Brunswick
QC	Quebec
ON	Ontario
MB	Manitoba
SK	Saskatchewan
AB	Alberta
BC	British Columbia
NT	Northwest Territories
YT	Yukon Territory
NU	Nunavut



ANALYSIS



Safe working procedures and conditions, accident prevention, and the preservation of health are of primary importance to industry in Canada. These responsibilities are shared and require the joint efforts of government, employers and employees. It is imperative that all parties are aware of circumstances and conditions that may lead to injury or harm. Safe learning experiences and work environments can be created by controlling the variables and behaviours that may contribute to accidents or injury.

It is generally recognized that safety-conscious attitudes and work practices contribute to a healthy, safe and accident-free work environment.

It is imperative to apply and be familiar with the Occupational Health and Safety (OH&S) Acts and Workplace Hazardous Materials Information System (WHMIS) Regulations. As well, it is essential to determine workplace hazards and take measures to protect oneself, co-workers, the public and the environment.

Safety education is an integral part of training in all jurisdictions. As safety is an imperative part of all trades, it is assumed and therefore it is not included as a qualifier of any activities. However, the technical safety tasks and sub-tasks specific to the trade are included throughout this analysis.

SCOPE OF THE PLUMBER TRADE

"Plumber" is this trade's official Red Seal occupational title approved by the CCDA. This analysis covers tasks performed by plumbers whose occupational title has been identified by some provinces and territories of Canada under the following names:

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
Pipefitter – Plumber Specialty					✓								
Plumber	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓

Plumbers install, repair and maintain plumbing fixtures and systems such as water, hydronic, drain, waste and vent (DWV), low pressure steam, residential fire, chemical, and irrigation. They also install specialized systems such as medical gas, process piping, compressed air, water conditioners, fuel piping, sewage and water treatment, and storage and flow equipment. Plumbers interpret drawings, refer to layouts of existing services, and review applicable codes and specifications to determine work details and procedures. They locate and mark positions for fixtures, pipe connections and sleeves, and cut openings to accommodate pipe and fittings.

Plumbers may be employed by plumbing/mechanical contractors, service companies, and maintenance departments of manufacturing, commercial, health care and educational facilities. They may also be self-employed. Plumbers install piping and equipment in residential, commercial, institutional and industrial buildings and sites.

Plumbers use a variety of tools and equipment, such as power tools, welding and soldering/brazing equipment, and hoisting and lifting equipment to perform the tasks in their trade. To perform some tasks or use some equipment, specific certification may be required. Plumbers work with a variety of piping materials such as copper, steel, plastic, glass, cast iron, cement, fibreglass and specialty materials. Before assembling and fitting pipe sections, tubing and fittings, the pipes must be measured, cut and bent as required. Joining pipe may be done by various means, such as threading, using mechanical joints, welding, soldering/brazing and using fastening materials and compounds. Plumbers test and commission systems to ensure proper operation. They perform scheduled, unscheduled and emergency maintenance and repair.

Safety awareness is essential for plumbers. They may work indoors or outdoors and working conditions vary from one job to another. The work of plumbers can be physically demanding. Plumbers often need to lift and carry heavy materials and equipment. While performing their duties, plumbers are also required to do considerable standing, climbing and kneeling. They may work at heights and in confined spaces. Special precautions may have to be taken when working with fluids, gases, steam and hazardous elements. Plumbers need to assess the systems and the environment they have to work in to identify possible dangers.

Key attributes for people entering this trade are good mechanical, mathematical and spatial visualization skills. Plumbers also need good communication skills to communicate with co-workers and clients. Analytical/problem solving skills are required to interpret building plans, inspect piping systems and diagnose system faults and/or malfunctions.

This analysis recognizes some similarities or overlaps with the work of gas fitters, steamfitters/pipefitters, refrigeration and air conditioning mechanics and sprinkler system installers.

With experience, plumbers act as mentors and trainers to apprentices in the trade. They may also move into other positions such as instructors, inspectors, estimators and project managers.

OCCUPATIONAL OBSERVATIONS

With advances in plumbing and heating systems, plumbers are increasingly required to upgrade their skills to stay current or specialize in certain aspects of the trade. Updates to the National Plumbing Code (NPC) are resulting in an increased emphasis on health and safety, environmental protection, and reliable and efficient piping systems.

New approaches are being used to install more sophisticated systems and fixtures, such as low consumption fixtures and high efficiency boilers. Technological advances are influencing the design for water supply, DWV, gas fitting and hydronic heating/cooling. New technologies are also affecting gas and water piping and increasing the use of integrated plumbing systems in home construction. Computers are now being used as a more common source for resource information, communication and cost reporting. They are also used as a tool for design, layout, research, system diagnosis and estimating.

Some of the tools that have become more commonly used are embedment scanners, cameras, global positioning systems (GPS) and scopes. Fusion welding is becoming more prevalent in gas lines, and geothermal, sewage, water distribution and hydronic systems.

Industry is becoming more conscious of energy usage and efficiency of equipment and systems resulting in the introduction of programs such as Leadership in Energy and Environmental Design (LEED) and Enerstar strive for lowered energy consumption. Plumbers must now be more aware of the impact the trade has on the environment, the emerging requirements of these programs and the specific site requirements that are critical to the projects. Many buildings are being built to environmental standards that require specialized products and systems. This may include concepts such as the capture of runoff water and absence of volatile organic compounds (VOCs) in materials and products.

ESSENTIAL SKILLS SUMMARY

Essential skills are needed for work, learning and life. They provide the foundation for learning all other skills and enable people to evolve with their jobs and adapt to workplace change.

Through extensive research, the Government of Canada and other national and international agencies have identified and validated nine essential skills. These skills are used in nearly every occupation and throughout daily life in different ways.

The essential skills profile for the plumber trade indicates that the most important essential skills are **document use**, **oral communication** and **problem solving**.

The application of these skills may be described throughout this document within the competency statements which support each sub-task of the trade. The following are summaries of the requirements in each of the essential skills, taken from the essential skills profile. A link to the complete essential skills profile can be found at www.red-seal.ca.

Reading

Plumbers require strong reading skills to consult installation procedures, reference manuals, Material Safety Data Sheets (MSDS), the NPC and industry standards and safety requirements when installing, repairing and maintaining plumbing fixtures and systems. They also refer to project specifications and work orders when planning a job.

Document Use

Document use is important in the work of plumbers. Plumbers interpret diagrams in the NPC to ensure compliance with regulatory standards. They interpret schematics and working drawings when planning the installation of piping systems. Plumbers read assembly drawings to install fixtures and appliances. They prepare sketches and drawings to plan a job.

Writing

Writing skills are used by plumbers to perform tasks such as writing lists of materials required for a job, completing order forms to request materials, and keeping daily logs to track work status and reminders. When required, they must write incident or accident reports.

Oral Communication

Plumbers require good oral communication skills to interact with colleagues, apprentices, supervisors, suppliers, clients and other tradespersons when co-ordinating work, resolving problems and ensuring safety.

Numeracy

Plumbers work in both imperial and metric systems of measurement. They locate and mark positions for pipe connections. They perform a variety of calculations such as offsets, drain line fall, hydraulic load, and temperature and pressure calculations depending on the type of piping system being installed. Plumbers estimate materials and supplies needed to complete a project. They may estimate labour requirements and prepare quotations and invoices.

Thinking Skills

Plumbers diagnose and solve problems identified by clients. They decide on work priorities and plan and organize their work accordingly. Plumbers may determine the most cost effective way to use materials and supplies when installing plumbing and heating systems.

Working with Others

During the course of a work day, plumbers must interact with others such as co-workers, suppliers, clients and other trades.

Computer Use

Plumbers use computers as a more common source for resource information, communication and cost reporting. They are also used as a tool for design, layout, research, system diagnosis and estimating.

Continuous Learning

Changes to the NPC periodically modify procedures and methods for the design and installation of piping systems. Advances in technology are also changing the design, applications and materials of systems. There is an increased emphasis on worker health and safety. All these changes mean that related training and certification is often mandatory for both apprentices and journeypersons.

BLOCK A

OCCUPATIONAL SKILLS

Trends	GPS has been used for layout, surveying and planning. Safety and third party certification has become increasingly important and monitored. Upcoming technologies such as Building Information Modelling (BIM) provide a virtual model to be used with layout. Specialized tools such as plastic fusion welders and press pipe applicators are becoming more common because of new materials and equipment.
Related Components	All components apply.
Tools and Equipment	See Appendix A.

Task 1 Performs safety-related functions.

Context	Plumbers are responsible for ensuring the safety of themselves and others in the work environment. They should be able to follow company, local and other jurisdictional requirements. It is critical that plumbers be constantly aware of their surroundings and the hazards that they may encounter.
----------------	--

Required Knowledge

K 1	safety training and requirements for hazards such as fall protection and confined space
K 2	workplace hazards such as live electrical power, open trenches and toxic atmosphere
K 3	workplace hazard assessment procedures
K 4	types of safety equipment such as first aid kits, eye wash kits and fire extinguishers
K 5	types and uses of personal protective equipment (PPE) and their components
K 6	manufacturers' recommended uses, limitations and maintenance of PPE
K 7	locations of PPE and safety equipment

K 8	jurisdictional safety and health regulations and policies such as WHMIS, transportation of dangerous goods (TDG) and company safety policies
K 9	lock-out and tag-out procedures
K 10	emergency contact information such as addresses for hospitals, public utilities, and environmental and health authorities
K 11	emergency procedures such as muster points and evacuation procedures
K 12	hot work permits and fire watch requirements

Sub-task

A-1.01 Maintains safe work environment.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-1.01.01	maintain good housekeeping on an ongoing basis to ensure safety and efficiency of the work site
A-1.01.02	access and use WHMIS information when handling hazardous materials and addressing hazardous conditions
A-1.01.03	transport dangerous goods such as high pressure cylinders and chemicals according to Authority Having Jurisdiction (AHJ)
A-1.01.04	use powder-actuated tools within operating limitations according to AHJ, specifications and site requirements
A-1.01.05	participate in safety meetings and discussions to ensure that information is recorded and distributed as required
A-1.01.06	report injuries according to AHJ, using appropriate forms and ensuring that documentation is in place
A-1.01.07	use safety equipment such as barriers, signage and caution tape to alert all persons on site to potential hazards
A-1.01.08	recognize and report potential hazards such as hot work, confined space and working at heights, and use procedures to reduce hazards
A-1.01.09	follow confined space procedures according to AHJ and site requirements

Sub-task**A-1.02 Uses personal protective equipment (PPE) and safety equipment.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-1.02.01	select and wear PPE such as safety boots, hard hats and eye protection according to AHJ and site requirements
A-1.02.02	select and use specialized PPE such as air monitors and respiratory equipment according to AHJ and site requirements
A-1.02.03	locate and use safety equipment such as fire extinguishers, air horns and first aid kits
A-1.02.04	recognize, tag and dispose of worn, damaged and defective PPE and safety equipment
A-1.02.05	store PPE and safety equipment in proper manner and location

Sub-task**A-1.03 Handles hazardous materials.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-1.03.01	recognize potentially hazardous materials currently and historically used in the plumbing trade such as pipe dope, cutting oil and solvents
A-1.03.02	use, transport, store and dispose of hazardous materials according to regulations such as TDG and WHMIS
A-1.03.03	complete documentation as required by AHJ and site requirements
A-1.03.04	contain, report and document spills as required by AHJ and site requirements

Sub-task**A-1.04 Performs lock-out and tag-out procedures.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-1.04.01	identify components that may require lock-out and tag-out such as valves, pumps and motors
A-1.04.02	coordinate shut down of equipment and components in proper sequence to protect personnel from injury and equipment from damage
A-1.04.03	coordinate lock-out and tag-out with other trades, maintenance personnel and users to avoid consequences such as injuries to personnel and damage to equipment
A-1.04.04	label lock-outs and tag-outs according to site requirements
A-1.04.05	apply and test individual lock-outs and tag-outs to ensure that system cannot be accidentally restarted according to AHJ, and company and site requirements
A-1.04.06	remove lock-outs and tag-outs upon completion of task and once safe operation of system can be ensured according to AHJ, and company and site requirements
A-1.04.07	install components such as blind flanges and spades as required to prevent injury to personnel

Task 2**Uses and maintains tools and equipment.**

Context	Tools and equipment must be used, maintained and stored in a safe manner to enable the plumber to complete all tasks of the plumbing trade. Plumbers should be aware that the requirements for the maintenance and operation of tools and equipment can vary.
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Required Knowledge

K 1	types and uses of tools such as hand, air, power, powder-actuated tools, and cutting and welding equipment
K 2	operating procedures for tools and equipment
K 3	training and certification requirements to perform activities such as rigging and hoisting, and operating equipment

K 4	types and uses of access equipment such as scaffolds, ladders and power-elevated work platforms
K 5	manufacturers' recommended uses, limitations and maintenance of tools and equipment
K 6	rigging, hoisting and lifting equipment components such as chain falls, come-alongs, slings, shackles, spreader bars, softeners and cables
K 7	knots
K 8	tool and equipment safety
K 9	operating procedures and hand signals for hoisting and lifting equipment
K 10	components of tools and equipment
K 11	rigging, hoisting and lifting equipment safety
K 12	company, site and AHJ requirements

Sub-task

A-2.01 Maintains tools and equipment.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-2.01.01	sharpen hand tools such as chisels and drill bits
A-2.01.02	lubricate tools such as pipe cutters, snips and pliers
A-2.01.03	inspect tools for unsafe conditions such as missing parts, defective guards and frayed cords
A-2.01.04	recognise and report worn, damaged and defective tools and equipment
A-2.01.05	repair and replace broken parts
A-2.01.06	adjust and/or calibrate tools such as threaders and groovers
A-2.01.07	store tools and equipment in a clean and dry location to ensure they are in operating condition
A-2.01.08	store powder-actuated tools, shots and pins in a safe manner to avoid misuse and accidental discharge
A-2.01.09	dispose of defective shots to prevent accidental discharge
A-2.01.10	inspect, clean and store equipment such as hoses, regulators, bottles and gauges on a regular basis to detect defects such as leaks, cuts in hoses and damage to gauges
A-2.01.11	clean and inspect tools according to specifications

Sub-task**A-2.02 Uses access equipment.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-2.02.01	select ladders and work platforms taking into consideration length, height, site conditions and task being performed
A-2.02.02	assemble and erect scaffolding and extension ladders according to operating procedures, AHJ and site requirements
A-2.02.03	recognize unsafe and defective equipment by identifying tags or by performing a visual inspection
A-2.02.04	inspect and maintain ladders and work platforms prior to, during and after use with methods such as visual inspection, performing walk-around and cleaning platforms
A-2.02.05	use equipment within operating limitations as indicated on manufacturers' tags and according to AHJ and site requirements
A-2.02.06	restrict access to scaffolding and ladders according to AHJ and site requirements

Sub-task**A-2.03 Uses rigging, hoisting and lifting equipment.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-2.03.01	select equipment for task considering factors such as weight, loads and distance to be travelled
A-2.03.02	inspect equipment such as slings, come-alongs and shackles for wear, damage and defects before each use, and remove defective equipment from service
A-2.03.03	identify hazards such as power lines, excavations and excessive loads
A-2.03.04	rig loads following load tables and proper rigging procedures to ensure safety and to prevent damage to rigging equipment and material
A-2.03.05	attach and use tag lines to guide and position loads

- | | |
|-----------|--|
| A-2.03.06 | use knots and lashes to secure loads and tag lines |
| A-2.03.07 | use hand signals or two-way radios to communicate with equipment operators |
| A-2.03.08 | store equipment in clean and dry conditions, and according to specifications |

Task 3

Organizes work.

Context Organization of the work directly affects job performance and impacts the schedule. A plumber must be able to organize project tasks and materials to complete the project in a safe and timely manner.

Required Knowledge

- | | |
|------|---|
| K 1 | types of documentation such as plumbing codes, and manufacturers', engineering and architectural specifications |
| K 2 | types of drawings such as structural, architectural, mechanical, electrical, isometric, orthographic, oblique and shop drawings |
| K 3 | AHJ and site requirements |
| K 4 | site-specific documents such as change orders, site instructions and revisions |
| K 5 | metric and imperial measurements |
| K 6 | trade terminology |
| K 7 | communication equipment |
| K 8 | job requirements and sequencing |
| K 9 | material availability |
| K 10 | assigned work |
| K 11 | work performed by other tradespersons |
| K 12 | company safety policies and guidelines |
| K 13 | tool box meetings and company safety bulletins |
| K 14 | WHMIS information such as labels and MSDS |

Sub-task**A-3.01 Organizes project tasks and procedures.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-3.01.01	obtain all required job permits
A-3.01.02	develop and follow job schedule throughout the project to ensure orderly and timely progression
A-3.01.03	organize tools and equipment usage to make sure the right tools and equipment are available when needed
A-3.01.04	coordinate labour resources to ensure that the tasks are completed efficiently and deadlines are met
A-3.01.05	adapt to environmental conditions to minimize impact of project delays
A-3.01.06	record daily events for future reference and schedule impacts

Sub-task**A-3.02 Organizes materials and supplies.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-3.02.01	estimate material and supplies needed to prevent cost overruns and to enable smooth operation of project
A-3.02.02	select and order material and equipment for task according to site requirements and specifications
A-3.02.03	schedule the use of material and supplies throughout the project to enable successful completion
A-3.02.04	arrange for secure and organized storage of materials and supplies to prevent theft and damage, and to ensure availability

Task 4**Performs routine trade activities.**

Context Plumbers perform this work on a regular basis throughout the trade. A journey person should be able to design systems based on good engineering practices and applicable codes. This may require additional training and/or certification to accomplish these tasks.

Required Knowledge

- | | |
|------|---|
| K 1 | layout of piping systems |
| K 2 | types of supports, hangers and restraints, and their properties |
| K 3 | types of material being supported |
| K 4 | types of fasteners such as beam clamps, drop-in anchors, draw bolts and toggle bolts |
| K 5 | requirements for sleeve installation |
| K 6 | test procedures |
| K 7 | pre-commissioning checks and procedures |
| K 8 | commissioning of systems |
| K 9 | water quality inspection reports |
| K 10 | piping system being worked on |
| K 11 | piping and plumbing equipment |
| K 12 | frost protection equipment such as electric tracer, frost boxes and circulating pumps |
| K 13 | ultraviolet (UV) protection |
| K 14 | corrosion protection such as coatings and tape |
| K 15 | physical damage protection such as protective plates, grommets and underground sleeving |
| K 16 | types of fire stopping systems and their specifications |
| K 17 | regulations, specifications and site requirements for excavation and backfilling |
| K 18 | mathematical formulas needed to calculate pipe length and piping offsets |

Sub-task**A-4.01 Performs piping system layout.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-4.01.01	lay out final position of fixtures, equipment, piping and components according to drawings, AHJ, specifications and site conditions
A-4.01.02	select and use tools and equipment such as levels, builders' levels, tape measures and lasers
A-4.01.03	verify non-interference with other systems and trades

Sub-task**A-4.02 Calculates pipe length.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-4.02.01	select and use tools such as tape measures and drafting scales
A-4.02.02	use fitting allowances, gaps and measurements such as end-to-end, centre-to-centre and centre-to-end, to determine cut length of pipe
A-4.02.03	calculate pipe expansion using appropriate co-efficient of expansion values and/or tables in the NPC

Sub-task**A-4.03 Calculates piping offsets.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-4.03.01	select and use tools and equipment such as tape measures, calculators, squares and levels
A-4.03.02	identify measurements needed to determine the cut length of pipe based on conditions such as rise and run of pipes, spacing of pipes and required angles
A-4.03.03	apply appropriate mathematical formula to calculate bending and rolling offsets
A-4.03.04	use fitting allowances, gaps and measurements such as end-to-end, centre-to-centre and centre-to-end, to determine cut length of pipe

Sub-task**A-4.04 Installs piping with adequate support.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-4.04.01	select hangers based on pipe size, contents and material to provide adequate support and to prevent damage to piping
A-4.04.02	select adequate supports for seismic restraint as required
A-4.04.03	space supports and hanger systems according to the NPC and specifications
A-4.04.04	assemble supports and hangers according to specifications
A-4.04.05	attach supports and hangers to structural members such as concrete, wood and steel beams
A-4.04.06	select and use tools and equipment such as powder-actuated tools, hammer drills and chop saws
A-4.04.07	install components such as anchors and guides according to specifications to prevent swaying and buckling of pipe
A-4.04.08	install supports and hanger systems according to size of pipes and materials used

Sub-task**A-4.05 Installs sleeves.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-4.05.01	lay out sleeves according to drawings to ensure proper placement
A-4.05.02	select sleeves according to specifications and pipe size to provide adequate space for insulation and fire stopping
A-4.05.03	fabricate sleeves from appropriate material such as pipe and sheet metal as required
A-4.05.04	select and use tools and equipment such as coring drills, tin snips, grinders and hole saws
A-4.05.05	cut hole according to sleeve size by using methods such as coring, drilling and cutting
A-4.05.06	fasten sleeves to structures such as metal decking, formwork and block wall
A-4.05.07	protect sleeves during the concrete pour to prevent blockage and misalignment

Sub-task**A-4.06 Tests piping and plumbing systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-4.06.01	determine type of test required such as destructive, non-destructive, hydrostatic, pneumatic and smoke according to AHJ, specifications and site requirements
A-4.06.02	select and use tools and equipment such as compressors, gauges and test plugs
A-4.06.03	take safety precautions such as advising other trades, and erecting barriers and signs
A-4.06.04	isolate piping and equipment not required for the test such as pumps, valves and air vents to prevent damage

A-4.06.05	detect leaks using methods and materials such as soap and water, gauges and chart recorders
A-4.06.06	pressurize and depressurize plumbing system according to type of test
A-4.06.07	record test results upon completion

Sub-task

A-4.07 Commissions systems.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-4.07.01	follow documentation such as manufacturers' instructions and engineering specifications
A-4.07.02	flush, degrease lines and remove start-up strainers prior to commissioning system to remove foreign matter such as debris and scale
A-4.07.03	fill system to operating levels and pressure
A-4.07.04	add chemicals such as glycol and inhibitors for reasons such as prevention of freezing and deterioration
A-4.07.05	start up system to verify operation
A-4.07.06	verify and adjust components such as sensors, flushometers and aquastats to ensure safe operation of system
A-4.07.07	clean, flush and sanitize potable water systems prior to occupancy
A-4.07.08	record information such as chemicals added, date of commissioning and pressure readings
A-4.07.09	provide documents such as manuals, as-built drawings and maintenance schedules as required

Sub-task**A-4.08 Protects piping systems, equipment and structure from damage.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-4.08.01	make watertight penetrations through building envelope with use of materials such as flashings and vent terminations
A-4.08.02	install dielectric protection where dissimilar metals come into contact to prevent electrolysis where required
A-4.08.03	install heat tracing and insulation to prevent freezing of piping contents
A-4.08.04	install components such as spring hangers and isolators, flex connectors and seismic restraints on piping and equipment to prevent damage from vibration or other movement
A-4.08.05	install expansion joints in piping systems to allow for thermal expansion and settling of structures
A-4.08.06	apply coatings and tape to protect piping from corrosion
A-4.08.07	layout housekeeping pads for pumps and equipment
A-4.08.08	install shock arrestors to protect systems from water hammer
A-4.08.09	protect embedded components as required according to AHJ, specifications and site requirements
A-4.08.10	install backflow prevention devices to protect potable water systems from cross-connection

Sub-task**A-4.09 Coordinates excavation and backfilling of trenches.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-4.09.01	obtain permits where required
A-4.09.02	lay out and mark excavation route
A-4.09.03	coordinate with utility companies to locate underground utilities to avoid consequences such as damage to utilities and injuries to personnel
A-4.09.04	determine excavation requirements such as depth, grade and bedding

A-4.09.05	schedule equipment such as backhoes, jackhammers and tampers to ensure equipment is available for excavation
A-4.09.06	verify that safety procedures are followed such as ensuring slope of trench walls, and use of shoring and cages or trench boxes
A-4.09.07	select backfill material according to AHJ, specifications and site conditions
A-4.09.08	supervise backfilling according to AHJ, specifications, site conditions and site requirements

Sub-task

A-4.10 **Installs fire stopping systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-4.10.01	identify locations where fire stopping systems are required to prevent potential spread of fire and smoke
A-4.10.02	select fire stopping system according to specifications and materials
A-4.10.03	select and use tools and equipment such as screw guns and hammer drills
A-4.10.04	anchor fire stopping collars to building structure with methods such as screwing, wrapping and pinning
A-4.10.05	apply approved fire stopping material to fill gaps and cavities around penetrations in walls and floors
A-4.10.06	secure fire stopping material to pipe following AHJ and specifications

BLOCK B

PIPING PREPARATION AND ASSEMBLY

Trends

Specialized systems are becoming more commonly used due to cost and material availability. Materials such as glues for tube and tubing, fittings for joining plastic pipe and fusion fittings are also becoming more widely used due to the same factors.

Changes in technology such as computer-aided design and manufacturing (CAD/CAM) have made the preparation of piping more efficient and cost-effective.

Copper systems are often being replaced by materials such as plastic.

Related Components

Tube, tubing, pipe, fittings.

Tools and Equipment

See Appendix A.

Task 5

Prepares pipe.

Context

Plumbers prepare tube, tubing and pipe for proper installation and trouble-free operation of the plumbing system. Preparation of tube, tubing and pipe may include inspection, cutting and bending. Tube is measured by nominal inside diameter (ID) and type, while some types of tubing are measured by outside diameter (OD) and wall thickness. Plumbers are responsible for the preparation of pipe for applications such as DWV, water distribution and other product conveyance such as chemicals.

Required Knowledge

- | | |
|-----|--|
| K 1 | types and sizes of tube such as K, L, M, and DWV |
| K 2 | types and sizes of tubing for applications such as medical gas, air conditioning and refrigeration (ACR), gas (G) and general purpose (GP) |
| K 3 | standard measuring procedures such as centre-to-centre, end-to-centre, and end-to-end |
| K 4 | restrictions on bending of tube, tubing and pipe |
| K 5 | common angles such as 90°, 45° and 22.5° |
| K 6 | applications commonly requiring bending such as fixture finishing, instrumentation and oil lines |

K 7	types of gaskets, fittings and lubricants used for tube, tubing and pipe
K 8	tube, tubing and pipe compatibility with the intended use such as water, oil and gas (WOG)
K 9	methods of preventing electrolysis
K 10	thermal expansion and contraction of tube, tubing and pipe
K 11	code requirements for joint construction
K 12	tube, tubing and pipe contents such as water, waste, chemicals and fuel
K 13	schedules, weights and composition of different types of tube, tubing and pipe
K 14	types of pipe such as plastic, copper and steel
K 15	types and grades of fittings such as cast iron, malleable iron and forged steel
K 16	types and grades of fastening hardware such as studs, bolts and nuts

Sub-task

B-5.01 Inspects tube, tubing, pipe and fittings before installation.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-5.01.01	perform visual inspection to detect faults such as damage, cracks and debris
B-5.01.02	confirm certification meets AHJ, specifications, site requirements and record approval markings as required
B-5.01.03	perform manual test such as sounding cast iron pipe, checking threads and confirming groove depth

Sub-task**B-5.02 Cuts tube, tubing and pipe.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-5.02.01	select and use tools and equipment such as pipe and tubing cutters, chop saws and reciprocating saws
B-5.02.02	select tube, tubing and pipe according to AHJ, specifications and site requirements
B-5.02.03	measure tube, tubing and pipe to determine length and location of cut
B-5.02.04	use cutting guides such as wraparounds to make a square cut
B-5.02.05	prepare tube, tubing and pipe ends using techniques such as reaming, bevelling, filing and grinding as required
B-5.02.06	inspect tube, tubing and pipe for damage after each cut using visual and audio techniques such as sounding cast iron pipe
B-5.02.07	support and secure tube, tubing and pipe for cutting

Sub-task**B-5.03 Bends tube, tubing and pipe.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-5.03.01	select and use tools and equipment such as lever and spring benders
B-5.03.02	identify types of tube, tubing and pipe such as soft, semi-soft and hard temper according to AHJ, specifications and site requirements
B-5.03.03	determine location and angle of required offsets or bends according to site requirements
B-5.03.04	measure and calculate distances between offsets and bends
B-5.03.05	determine increments on bending tool to achieve required angle
B-5.03.06	inspect tube, tubing and pipe after bending for distortions such as kinks and ripples

Task 6

Joins tube, tubing, pipe and fittings.

Context

Plumbers join tube, tubing and pipe to ensure trouble-free operation of systems. They use materials such as copper, plastic, steel, cast iron as well as specialized materials such as glass and stainless.

Copper pipe may be used for potable water systems, DWV and specialized systems.

Steel is one of the most widely used piping materials installed by plumbers in heating and process applications. Some examples of systems using steel pipe are fire standpipe, fuel piping and food processing.

Plastic pipe provides flexible installation and a cost-effective alternative to other types of pipe. Fibreglass pipe is also included in this task.

Cast iron has proven qualities that continue to make it a reliable material for drainage of sanitary and storm waste. Ductile cast iron pipe is widely used for water service and process piping.

Glass pipe is commonly used in laboratories, hospitals and chemical plants for corrosive waste. Small bore glass pipe is commonly used for such items as sight glasses.

Required Knowledge

- | | |
|-----|---|
| K 1 | types of joining materials such as rubber, lead and oakum, and cold caulking compounds |
| K 2 | types of fluxes for joining pipe |
| K 3 | joining methods such as brazing, soldering, welding, flaring, grooving, compression and crimping |
| K 4 | certification required to weld steel pipe and to braze copper pipe |
| K 5 | characteristics of solvent cements, primers and transition glues such as working time and set-up time |
| K 6 | glass pipe coupling configurations such as bead-to-bead, and bead-to-plain end |
| K 7 | types of pipe such as copper, plastic, steel, cast iron, glass, stainless, and their properties |
| K 8 | AHJ requirements |

Sub-task**B-6.01 Joins copper pipe.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-6.01.01	determine types of fittings and joining method based on AHJ, specifications and site conditions
B-6.01.02	select and use tools and equipment such as flaring tools, grooving tools and soldering equipment
B-6.01.03	set copper pipe in flaring or grooving tool
B-6.01.04	flare and swage pipe ends to ensure proper seal on fitting
B-6.01.05	groove pipe ends to proper depth, correcting imperfections on grooved ends
B-6.01.06	clean and lubricate mechanical joints to avoid pinching and to allow for proper tightening of clamp
B-6.01.07	tighten mechanical coupling to required rating
B-6.01.08	clean and flux pipe and fittings to prepare for soldering operations
B-6.01.09	position branch line on extracted tees prior to brazing, ensuring correct alignment of pipe in extracted tees
B-6.01.10	select soldering and brazing materials according to applications
B-6.01.11	purge pipe with nitrogen during brazing process to prevent oxidation of interior of pipe as required
B-6.01.12	solder assembly, ensuring adequate temperature to achieve required flow and capillary action of solder
B-6.01.13	clean pipe and fittings to prepare for brazing operations
B-6.01.14	brazing assembly, ensuring adequate temperature to achieve required flow and penetration of brazing materials
B-6.01.15	use proper distribution of heat on larger diameter pipe for soldering and brazing
B-6.01.16	assemble and install compression or push-fit fittings according to required depth and to specifications

Sub-task**B-6.02 Joins plastic pipe.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-6.02.01	determine types of joints and fittings, method of joining and appropriate materials to be used according to AHJ, specifications and site requirements
B-6.02.02	select and use tools and equipment such as crimping tools, expanders and heat plates
B-6.02.03	select glues and primers according to specifications
B-6.02.04	solvent weld plastic pipe according to type of pipe and specifications
B-6.02.05	set plastic pipe in grooving tool
B-6.02.06	groove pipe ends to proper depth according to specifications
B-6.02.07	clean and lubricate mechanical joints as required to avoid pinching and to allow for proper tightening of clamp
B-6.02.08	tighten mechanical joints to required rating
B-6.02.09	perform plastic welding techniques such as fuse welding, socket fusion and butt fusion according to type of pipe and specifications
B-6.02.10	crimp or expand PEX pipe to create a joint according to specifications
B-6.02.11	prepare hub and spigot joints by applying lubricant on pipe and gasket, according to specifications
B-6.02.12	assemble hub and spigot joints for pressure water and drainage systems according to specifications
B-6.02.13	assemble and install compression or push-fit fittings according to required depth and to specifications

Sub-task**B-6.03 Joins steel pipe.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-6.03.01	determine types of fittings and joining method according to AHJ, specifications and site requirements
B-6.03.02	select and use tools and equipment such as threaders, mechanical crimpers and groovers
B-6.03.03	support and align pipe and fittings for joining using techniques such as threading, using mechanical joints and crimping
B-6.03.04	thread steel pipe using lubricants as required, ensuring proper taper and length of threads
B-6.03.05	set steel pipe in grooving tool
B-6.03.06	groove steel pipe ends to proper depth
B-6.03.07	clean and lubricate mechanical joints to avoid pinching and to ensure proper tightening of clamp
B-6.03.08	tighten mechanical coupling to required rating
B-6.03.09	fabricate gaskets for flanged joints
B-6.03.10	use appropriate gasket and bolt tightening pattern for flanged joints according to specifications
B-6.03.11	prepare and grind fittings for butt welding and ensure proper shoulder distance based on AHJ, specifications and site requirements

Sub-task**B-6.04 Joins cast iron pipe.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-6.04.01	determine types of fittings and joining method based on AHJ, specifications and site requirements
B-6.04.02	select and use tools and equipment such as torque wrenches, nut drivers, come-alongs, ratchets and sockets

B-6.04.03	align pipe and fittings for joining
B-6.04.04	assemble pipe using joints such as MJ clamps, flanges, and hub and spigot with rubber inserts, oakum and cold caulking compound
B-6.04.05	identify locations where mechanical restraints are required
B-6.04.06	install mechanical restraints for cast and ductile iron pipe
B-6.04.07	tighten mechanical coupling to ensure even tension at required rating
B-6.04.08	use appropriate bolt tightening pattern for flanged joints

Sub-task

B-6.05 Joins specialized pipe.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>OC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-6.05.01	determine types of fittings and joining method based on AHJ, specifications and site requirements
B-6.05.02	identify and use tools and equipment required according to specifications
B-6.05.03	position pipe and fittings for joints such as mechanical and compression joints so they are correctly aligned
B-6.05.04	select and install system fittings according to AHJ and specifications
B-6.05.05	select and install transition fittings to different materials according to AHJ and specifications

BLOCK C

DRAINAGE, WASTE, VENTS AND SEWAGE TREATMENT SYSTEMS

Trends

New technologies in waste water treatment systems are becoming more prevalent due to environmental concerns.

Force main systems are becoming more common in applications such as municipal and sub-divisions around bodies of water.

Related Components (included, but not limited to)

Sewage systems: cleanouts, manholes, catch basins, force main systems.

Storm systems: roof and area drains, sump pumps.

Sanitary drainage and venting systems: interceptors, floor drains, sewage pumps, air admittance devices.

Sewage treatment systems: treatment plants, pumps, septic tanks, absorption fields, pressurized distribution systems, biofilters, aerating systems, liquid level alarms, filter beds.

Tools and Equipment

See Appendix A.

Task 7

Installs sewers.

Context

Plumbers install both sanitary and storm sewers. They may be responsible for the sizing of the sewer as well as installing manholes, catch basins and piping.

Required Knowledge

- | | |
|-----|--|
| K 1 | hydraulic load expressed in number of litres and fixture units |
| K 2 | AHJ requirements and specifications |
| K 3 | manholes, cleanouts, change of direction and elevation |
| K 4 | catch basin application |
| K 5 | manhole and catch basin construction |
| K 6 | soil conditions |
| K 7 | types of piping such as plastic, concrete and cast iron |

Sub-task**C-7.01 Sizes pipe for sewers.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-7.01.01	identify fixtures or storm water load for building
C-7.01.02	calculate total hydraulic load of building by referring to appropriate tables contained in the NPC
C-7.01.03	refer to sewer sizing tables in the NPC to obtain size of sewer pipe

Sub-task**C-7.02 Installs manholes and catch basins.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
no	no	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-7.02.01	locate and size manholes and catch basins according to drawings, AHJ and specifications
C-7.02.02	use tools and equipment such as levels and compactors to ensure base is level and stable
C-7.02.03	channel bottom of manhole to direct waste
C-7.02.04	select, lubricate and place gaskets to ensure manholes and catch basins are watertight and to avoid damage or reaction between lubricant and gaskets
C-7.02.05	modify manholes and catch basins for new laterals by making additional penetrations while maintaining structural integrity
C-7.02.06	seal penetration points to ensure water tightness
C-7.02.07	test manholes and catch basins by using methods such as hydrostatic, smoke and air testing to ensure watertight seal according to AHJ and specifications

Sub-task**C-7.03 Installs piping for sewers.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-7.03.01	lay out piping according to drawings, AHJ, specifications and site requirements and conditions
C-7.03.02	select piping material according to AHJ, specifications and site requirements
C-7.03.03	select and install cleanouts according to AHJ, specifications and site requirements
C-7.03.04	identify benchmark to set grade for piping
C-7.03.05	compact soil using proper backfill material to ensure stable base and to prevent damage to piping according to AHJ and specifications
C-7.03.06	verify pipe grade using tools and equipment such as laser and builder's levels
C-7.03.07	verify no cross-connection is present between storm and sanitary sewers using methods such as dye tests and visual inspections

Task 8**Installs sewage treatment systems.**

Context	Sewage treatment systems may encompass holding and septic tanks, absorption fields and sewage treatment plants. Regulations concerning the installation of sewage treatment systems may vary by jurisdiction. Secondary certification may be required in some jurisdictions to allow plumbers to plan and install these systems. Plumbers may be required to maintain and repair these systems and must have basic knowledge of how they are planned, installed and operated.
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Required Knowledge

K 1	types of sewage treatment systems such as septic tanks, sewage treatment plants and absorption fields
K 2	sewage treatment system components such as tanks, absorption fields and pump chambers
K 3	AHJ requirements
K 4	soil conditions

K 5	limiting factors for location of sewage treatment systems such as undesirable soil conditions, location of property boundaries and water table elevation
K 6	operation of sewage systems such as septic, aeration, holding and pumping chambers
K 7	gaskets and sealants

Sub-task

C-8.01 Plans installation of sewage treatment systems.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	no	yes	yes	yes	no	yes	NV	NV	NV

Key Competencies

C-8.01.01	determine type of system required by performing percolation tests and by identifying factors such as soil conditions and expected daily volume of sewage
C-8.01.02	prepare and submit a site plan to AHJ in order to obtain permits
C-8.01.03	select and size sewage treatment system components such as pumps, tanks and septic fields according to AHJ
C-8.01.04	determine proper depth of piping and components according to AHJ
C-8.01.05	confirm that adequate bedding material is present according to type of system and AHJ

Sub-task

C-8.02 Installs sewage treatment system components.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	no	yes	yes	yes	no	yes	NV	NV	NV

Key Competencies

C-8.02.01	assemble and place piping and components such as pumps, filters, tanks and controls according to site plans and AHJ
C-8.02.02	install and secure tanks according to AHJ, specifications and site conditions such as high water table and limiting layer

- | | |
|-----------|---|
| C-8.02.03 | adjust elevation and position of piping and components according to site conditions |
| C-8.02.04 | select, lubricate and place gaskets such as rubber O-rings and butyl rubber seals to ensure tanks and components are watertight |

Task 9

Installs rough-in for interior drainage, waste and vent (DWV) systems.

Context

Plumbers install both underground and above-ground piping and components for DWV systems.

Underground systems are defined as piping systems in direct contact with the earth.

Embedded components are encased in concrete or other materials.

Required Knowledge

- | | |
|------|--|
| K 1 | hydraulic load expressed in number of litres and fixture units |
| K 2 | AHJ requirements |
| K 3 | types of vents such as continuous, wet and dry |
| K 4 | types of piping and fittings used in underground and above-ground applications |
| K 5 | types of components such as interceptors, backwater valves and cleanouts |
| K 6 | soil conditions |
| K 7 | types of embedded components such as floor drains, roof drains, sleeves, sumps, sewage tanks and trap seal primers (TSP) |
| K 8 | embedded component material such as plastic, copper and cast iron |
| K 9 | finished elevation of components |
| K 10 | pipe support devices such as hangers, riser clamps and attachment hardware |

Sub-task**C-9.01 Sizes pipe for interior drainage, waste and vent (DWV) systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-9.01.01	identify fixtures or storm water load
C-9.01.02	size sanitary drainage system and associated vent piping by calculating total hydraulic load according to AHJ
C-9.01.03	size storm drainage system by calculating total hydraulic load according to AHJ

Sub-task**C-9.02 Installs underground piping and components for interior drainage, waste and vent (DWV) systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-9.02.01	lay out piping, stacks and fixtures
C-9.02.02	use tools and equipment such as tampers, jackhammers and levels
C-9.02.03	assemble components according to specifications
C-9.02.04	determine elevation of embedded components such as drains, sumps, TSPs and cleanouts in relation to finished floor
C-9.02.05	secure components using methods such as backfilling and fastening with clamps
C-9.02.06	install and align components as required
C-9.02.07	verify proper operation of components
C-9.02.08	select materials according to AHJ and specifications
C-9.02.09	calculate required slope of piping to determine adequate depth when entering/exiting the building
C-9.02.10	excavate and compact trench to prevent settling of piping
C-9.02.11	backfill trench once testing is complete using appropriate material and ensuring adequate protection of piping according to AHJ

C-9.02.12	cover open ends of piping to protect them from debris
C-9.02.13	size and install sewage lift stations when fixtures are installed below sanitary grade

Sub-task

C-9.03 Installs piping and components for interior drainage, waste and vent (DWV) systems above-ground.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-9.03.01	lay out piping and components according to AHJ and specifications
C-9.03.02	use tools and equipment such as torches, tubing cutters and hacksaws
C-9.03.03	identify storm and sanitary drainage systems to avoid cross-connection
C-9.03.04	drill holes in building components to accommodate piping according to AHJ
C-9.03.05	ensure adequate slope of piping for drainage according to AHJ
C-9.03.06	label piping for identification purposes according to AHJ, specifications and site requirements

BLOCK D

WATER SERVICE AND DISTRIBUTION

Trends

There is an increased use of plastic piping and fitting materials, with a corresponding decrease in the use of copper materials.

Due to changes in codes and jurisdictional regulations, the awareness and importance of cross-connection control has increased.

Tempered water systems are becoming mandatory.

Related Components (included, but not limited to)

Pumps: submersible, jet, deep-well jet, circulating, booster.

Piping: copper, plastic, ductile, stainless steel.

Tanks: pressure, hot water, storage.

Cross-connection control devices: double check valves, reduced pressure valves, atmospheric vacuum breakers, pressure vacuum breakers.

Accessories: pressure switches, level switches, gauges, check valves, pressure relief valves, pressure reducing valves, tempered water valves.

Tools and Equipment

See Appendix A.

Task 10

Installs water services.

Context

By connecting piping from the municipal or private water supply to the water distribution system, plumbers make water available for use. The first step is to determine water demand in order to be able to size and install pipes and equipment.

Required Knowledge

- | | |
|-----|---|
| K 1 | AHJ requirements |
| K 2 | types of fixtures |
| K 3 | fixture units |
| K 4 | supply water pressure at the source |
| K 5 | water requirements for fire suppression systems and building or system demand |
| K 6 | piping materials such as copper, plastic, ductile and stainless steel |

K 7	joining methods such as flaring, brazing, welding, and using flanged, compression and mechanical joints (bell and spigot)
K 8	types of water service equipment such as backflow prevention devices, water meters, flow restrictors and pressure reducing valves
K 9	frost protection methods such as recirculation, frost box and heat tracing
K 10	requirements for system sizing such as length of pipes and elevation of system

Sub-task

D-10.01 Sizes pipe for water services.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-10.01.01	calculate required peak demand flow for water service considering factors such as fire suppression requirements for residential applications and system demand according to AHJ and specifications
D-10.01.02	determine pipe size considering factors such as total number of fixture units, developed length of pipe, most remote outlet, difference in elevation and available system pressure according to AHJ and specifications

Sub-task

D-10.02 Installs piping for water services.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-10.02.01	select piping materials and fittings for water service installation according to AHJ, specifications and site requirements
D-10.02.02	select and use tools and equipment such as come-alongs, pry bars and builder's levels
D-10.02.03	lay out location and elevation of water service according to drawings, specifications and site requirements
D-10.02.04	select and coordinate placement of bedding and backfilling material according to AHJ

D-10.02.05	align piping and fittings to facilitate joint assembly
D-10.02.06	install fittings according to AHJ and specifications
D-10.02.07	install restraints such as thrust blocks or mechanical restraints according to AHJ as required

Sub-task

D-10.03 Installs water service equipment.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-10.03.01	select and assemble components such as water meters, isolation valves and cross-connection control devices according to AHJ, specifications and site requirements
D-10.03.02	select and use tools and equipment such as ratchets, torches and wrenches
D-10.03.03	tighten bolts on flanges according to recommended bolt tightening pattern and torque ratings
D-10.03.04	connect selected equipment and components according to AHJ, specifications and site requirements

Task 11

Installs potable water distribution systems.

Context	Plumbers install potable water distribution systems by connecting the piping from the water service to equipment and fixtures. Plumbers must select the appropriate materials and properly size the system to deliver adequate water supply. By installing cross-connection devices, the water supply is protected from contamination.
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Required Knowledge

K 1	AHJ requirements
K 2	types of fixtures
K 3	fixture units
K 4	supply water pressure at the main
K 5	minimum and maximum allowable water pressure

K 6	piping materials such as copper, plastic and stainless steel
K 7	types of piping configurations such as branch and home run
K 8	joining methods such as soldering, brazing, crimping, fusion welding, and using flanged, compression and mechanical joints
K 9	rough-in requirements for piping of equipment and fixtures
K 10	types of potable water distribution equipment such as hot water storage tanks and hot water recirculation systems
K 11	domestic hot water heating equipment such as boilers and heat exchangers
K 12	types of potable water distribution components such as pressure reducing valves and pressure relief valves
K 13	tempered water valves and equipment
K 14	requirements for isolation of equipment and fixtures
K 15	types of cross-connection control devices such as double-check valve assemblies, reduced pressure principle devices and atmospheric vacuum breakers
K 16	installation requirements such as height, location and accessibility
K 17	certification requirements for testing and confirming operation of cross-connection control devices

Sub-task

D-11.01 Sizes piping and equipment for potable water distribution systems.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-11.01.01	calculate required peak demand flow for potable water distribution system considering factors such as current and future demand
D-11.01.02	verify size of water service and existing pressure to determine capacity to meet demand
D-11.01.03	select equipment such as pumps, pressure reducing valves, hot water tanks, tempering valves, cross-connection controls and pressure tanks according to AHJ, specifications and site requirements
D-11.01.04	determine pipe sizes considering factors such as total number of fixture units, developed length of pipe, most remote outlet, difference in elevation and available system pressure according to AHJ and specifications

Sub-task**D-11.02 Installs piping for potable water distribution systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-11.02.01	select piping materials according to AHJ, specifications and site requirements
D-11.02.02	select and use tools and equipment such as torches, crimping tools and cutters
D-11.02.03	lay out elevations and routing without compromising the structure
D-11.02.04	drill or cut adequately sized holes for piping at required elevations
D-11.02.05	install piping components such as fittings, valves, shock arrestors and expansion joints according to AHJ and specifications
D-11.02.06	label and stencil pipe for pipe identification according to AHJ, specifications and site requirements

Sub-task**D-11.03 Installs potable water distribution equipment.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-11.03.01	select potable water distribution equipment according to AHJ, specifications and site requirements
D-11.03.02	select and use tools and equipment such as pipe wrenches, adjustable wrenches and torches
D-11.03.03	connect selected equipment according to AHJ, specifications and site requirements using components such as isolation valves, flex connectors and check valves
D-11.03.04	select and install required valves such as pressure and temperature relief, vacuum relief, tempering and pressure reducing

Sub-task**D-11.04 Installs cross-connection control devices.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-11.04.01	determine level of hazard and select appropriate device for each hazard according to AHJ
D-11.04.02	determine location of device to ensure protection from frost, and to allow for accessibility for maintenance and testing according to AHJ
D-11.04.03	select and use tools and equipment such as wrenches and torches
D-11.04.04	connect cross-connection control devices to piping according to AHJ and specifications
D-11.04.05	test or arrange for testing of cross-connection control devices according to AHJ

Task 12**Installs pressure systems.**

Context	Plumbers install water systems that maintain pressure within distribution systems. The pressure system installation requires sizing and installing piping, equipment and other components that reduce or increase pressure as required.
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Required Knowledge

K 1	types of pumps such as submersible, and shallow and deep-well jet
K 2	components of pressure systems such as pressure switches and pressure tanks
K 3	system requirements such as pressure and demand
K 4	friction loss and head pressure
K 5	voltage and horsepower requirements
K 6	types of piping materials
K 7	grades of polyethylene pipe
K 8	types of well connections such as pitless adaptors, drive point (screened) and well seals

K 9	types of accessories such as torque arrestors, check valves, strainers, gauges, pressure and level switches, pressure tanks and pressure tank tees
K 10	heat tracing systems and insulation requirements
K 11	piping installation procedures for different types of pressure systems
K 12	water sources such as water service, wells, rivers and lakes
K 13	required permits

Sub-task

D-12.01 Sizes pressure systems.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-12.01.01	calculate required peak system demand for pressure systems according to AHJ, specifications and site requirements
D-12.01.02	calculate elevations and distances to determine sizes of components such as pressure tanks, pumps and piping
D-12.01.03	determine water source conditions such as drawdown, yield and depth
D-12.01.04	determine pressure system equipment required such as pumps, tanks and controls

Sub-task

D-12.02 Installs piping for pressure systems.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-12.02.01	determine required piping materials according to AHJ, specifications and site requirements
D-12.02.02	select and use tools and equipment such as wrenches, torches, nut drivers and cutters
D-12.02.03	identify location where water service is required
D-12.02.04	connect piping to components such as pumps, tanks and valves

Sub-task**D-12.03 Installs equipment and components for pressure systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

- | | |
|------------|---|
| D-12.03.01 | select and use tools and equipment such as wrenches, torches, cutters and nut drivers |
| D-12.03.02 | determine equipment and components required for pressure system installation such as pressure tanks, booster pumps, pressure reducing valves and pressure relief valves |
| D-12.03.03 | assemble equipment and components according to specifications |
| D-12.03.04 | attach cables and pitless adapter to facilitate removal of submersible pump for service and repairs as required |
| D-12.03.05 | coordinate power and control connections |

BLOCK E

FIXTURES, APPLIANCES AND WATER TREATMENT SYSTEMS

Trends

There is a trend towards more automated fixtures in public buildings. Higher water demand and public awareness of water quality has resulted in an increase in the use of water treatment systems and the efficient use of water resources.

Related Components (included, but not limited to)

Fixtures: water closets, urinals, bidets, lavatories, drinking fountains, bathtubs, showers, laundry tubs, sinks, bedpan washers.

Appliances: dishwashers, clothes washers, ice makers, refrigerators, commercial kitchen equipment, potato peelers, garbage disposal units, sterilizers.

Water treatment equipment: softeners, filters, UV sterilizers, reverse osmosis (RO) systems, de-ionizers.

Tools and Equipment

See Appendix A.

Task 13

Installs plumbing fixtures and appliances.

Context

Plumbers install fixtures and appliances in a variety of buildings. Plumbers must take care in the installation of fixtures and appliances since this is the finishing stage of the plumbing installation process.

Plumbing fixtures are connected to the water and/or drainage and/or electrical systems; appliances are generally connected to the electrical system as well as the water and/or drainage systems.

Required Knowledge

- K 1 types of fixtures such as drinking fountains, basins, water closets and urinals
- K 2 types of supports such as carriers, blocking and wall hangers
- K 3 mounting height
- K 4 wall and floor material and construction
- K 5 types of fasteners such as anchors, bolts and clamps
- K 6 fixture materials and finishes

K 7	barrier-free requirements and regulations
K 8	types of residential plumbing appliances such as dishwashers, ice makers and clothes washers
K 9	types of commercial plumbing appliances such as dishwashers, garbage grinders, ice makers and potato peelers
K 10	types of institutional plumbing appliances such as sterilizers and hospital cart washers
K 11	appliance materials and finishes
K 12	limitations of materials

Sub-task

E-13.01 Installs fixture supports.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

E-13.01.01	lay out fixture location according to drawings and specifications
E-13.01.02	mark location of required backing according to specifications
E-13.01.03	assemble fixture supports according to specifications
E-13.01.04	verify and install backing to ensure stability of fixture
E-13.01.05	use tools and equipment such as hammer drills and screw guns
E-13.01.06	mount supports to floor and walls using appropriate fasteners
E-13.01.07	level and plumb supports
E-13.01.08	set up multiple supports to ensure grade, spacing and alignment
E-13.01.09	coordinate installation of fixture supports with other trades

Sub-task**E-13.02 Installs plumbing fixtures.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

E-13.02.01	verify that rough-ins of carriers and plumbing connections are in appropriate locations and match fixture dimensions
E-13.02.02	select fixture and trim for specific application according to drawings, AHJ and specifications
E-13.02.03	use tools and equipment such as strap, spud and basin wrenches
E-13.02.04	complete assembly and adjustment of fixture supports to ensure proper installation
E-13.02.05	install fixture plumb and level
E-13.02.06	secure fixture using approved materials and methods to provide stability
E-13.02.07	connect water and drainage to ensure watertight installation
E-13.02.08	verify fixture placement meets standards according to AHJ regarding clearances
E-13.02.09	verify proper operation of fixture

Sub-task**E-13.03 Installs plumbing appliances.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

E-13.03.01	verify that rough-ins of supports and plumbing connections are in appropriate locations and match appliance dimensions, requirements and specifications
E-13.03.02	select appliance for specific application according to drawings and specifications
E-13.03.03	use tools and equipment such as levels, pipe wrenches and adjustable wrenches
E-13.03.04	complete assembly and adjustment of appliance supports
E-13.03.05	plumb and level appliance

- | | |
|------------|--|
| E-13.03.06 | secure appliance using approved materials and methods to provide stability according to specifications |
| E-13.03.07 | connect water and drainage to ensure watertight installation |
| E-13.03.08 | verify appliance placement meets standards according to AHJ regarding clearances |
| E-13.03.09 | verify proper operation of appliance |

Task 14**Installs water treatment systems.**

Context Water treatment systems are used in residential, commercial and institutional buildings to improve the quality of water. Plumbers may be responsible for sizing and installing these systems.

Required Knowledge

- | | |
|-----|---|
| K 1 | types of water treatment equipment such as water softeners, water filters, UV sterilizers, RO systems and de-ionizers |
| K 2 | composition of subject water such as hardness, pH level and turbidity |
| K 3 | contaminants |
| K 4 | chemical water treatment |
| K 5 | function of water treatment equipment |
| K 6 | service/regeneration interval of equipment (time and volume) |
| K 7 | cycles of water treatment equipment |
| K 8 | water quality and testing requirements |
| K 9 | limitations of materials |

Sub-task**E-14.01 Sizes water treatment equipment.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

E-14.01.01	collect water sample in an approved container from source according to AHJ
E-14.01.02	send sample for testing and analysis to assess water quality and characteristics such as hardness and pH
E-14.01.03	obtain results and interpret data to determine type of equipment for water treatment requirements
E-14.01.04	calculate water demand according to specifications
E-14.01.05	select and size system according to factors such as test results, demand, specifications, service regeneration intervals and space constraints

Sub-task**E-14.02 Installs water treatment equipment.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

E-14.02.01	verify that water treatment equipment matches determined demand and site requirements and conditions
E-14.02.02	determine location of installation according to specifications and service requirements
E-14.02.03	determine installation sequence according to specifications to ensure optimum operation
E-14.02.04	select and use tools and equipment such as wrenches, tubing cutters and torches
E-14.02.05	assemble water treatment equipment according to AHJ and specifications
E-14.02.06	plumb and level water treatment equipment
E-14.02.07	secure water treatment equipment using approved materials and methods to provide stability
E-14.02.08	connect water and drainage to ensure watertight installation

E-14.02.09 verify proper operation of equipment

E-14.02.10 collect and send water sample for analysis to ensure equipment is operating properly

BLOCK F

LOW PRESSURE STEAM AND HYDRONIC HEATING AND COOLING SYSTEMS

Trends

The use of computer programming in hydronic system control has become increasingly important and highly specialized, requiring plumbers to pursue ongoing training. Heating generating equipment has become more efficient. The use of hydronic radiant heating systems has increased. Although traditionally installed as a heat source, solar thermal panels are also recognized for their value as a cooling source.

Related Components (included, but not limited to)

Hydronic heating and cooling systems: pipe, circulating pumps, flanges, unions, Y-strainer and sidestream filters, check valves, isolation valves, pressure and temperature relief valves, pressure reducing valves, circuit balancing valves, air scoops, automatic air vents, flow switches, gauges, pot feeders, expansion tanks, low-water cutoffs, expansion joints.

Hydronic heating and cooling generating equipment: boilers, heat pumps, heat exchangers, solar panels, chillers, cooling towers.

Controls: thermostats, supply sensors, pump sensors, outdoor temperature sensors, programmable logic controls (PLCs).

Transfer units: in-floor heating, radiant panels, heat exchangers, force flow units, unit heaters, convectors.

Tools and Equipment

See Appendix A.

Task 15

Installs low pressure steam systems.

Context

Low pressure steam systems are used for processes such as sterilization, humidification, heat exchange and direct heating. This task includes the sizing and installation of piping and components.

Required Knowledge

- K 1 piping arrangements
- K 2 fittings such as flanges and unions
- K 3 pipe slope or grade

K 4	downstream and upstream pressures
K 5	types of valves and their appropriate ratings
K 6	component operation such as operating in direction of flow, regulating pressure and maintaining water quality
K 7	system media such as water and additives
K 8	types of boilers
K 9	low pressure steam system components and controls such as low water cut offs, condensate return pumps, gauges, converter, flashtanks, steam traps and strainers
K 10	operation of steam traps
K 11	codes for boiler safety controls
K 12	insulation requirements for steam installations
K 13	dangers of steam and condensate
K 14	high and low pressure hydronic systems
K 15	limitations of materials

Sub-task

F-15.01 Sizes piping and components for low pressure steam systems.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	no	yes	no	no	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-15.01.01	identify load requirements according to system being used, drawings and specifications
F-15.01.02	select required steam generator for load
F-15.01.03	determine pipe size according to load and distribution requirements
F-15.01.04	select and position components such as traps, strainers, drip legs and valves
F-15.01.05	select and position expansion joints such as bellows, piston and loop

Sub-task**F-15.02 Installs piping and components for low pressure steam systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	no	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-15.02.01	fit piping, components and accessories required together according to drawings, AHJ and specifications
F-15.02.02	determine routing according to drawings, specifications, site conditions, and equipment and component location
F-15.02.03	use tools and equipment such as threading equipment, cutters and torches
F-15.02.04	assist in setting up welding equipment safely according to AHJ
F-15.02.05	install piping plumb, level, straight or graded
F-15.02.06	locate and install drip legs for trapping of condensate
F-15.02.07	determine required condensate pump and install it according to drawings and specifications
F-15.02.08	select, install and maintain steam traps to ensure optimum operation of steam system
F-15.02.09	install anchors, guides and expansion joints to control movement of pipe
F-15.02.10	label and stencil pipe for pipe identification
F-15.02.11	verify proper operation of system
F-15.02.12	record and transfer heat numbers

Task 16**Installs hydronic heating and cooling piping systems.****Context**

While the temperature of the contents of these systems are different, the piping principles used in conventional hydronic, solar, geothermal/ground source heating and cooling installations are similar. High and low temperature systems use various or multiple heat sources, generators and exchangers. Cooling systems use methods such as heat exchangers, heat pumps, solar panels, cooling towers and chillers.

Required Knowledge

K 1	engineering specifications such as voltage, speed and rotation
K 2	high and low pressure/temperature hydronic systems

K 3	piping arrangements such as reverse-return, direct-return, primary-secondary and series loop
K 4	types of circulating pumps
K 5	flanges and unions
K 6	heating and cooling measurement units such as British Thermal Units (BTU), horsepower and kilowatts
K 7	pump size and position
K 8	downstream and upstream pressures
K 9	hydronic system components such as air scoops, flow switches, gauges, heat exchanger, pot feeders, expansion tanks and low-water cutoffs
K 10	types of valves such as makeup water, 3-way, isolation and zone
K 11	component operation such as operating in direction of flow, regulating pressure and maintaining fluid quality
K 12	system media such as water, glycol and additives
K 13	types of heat generators and cooling equipment
K 14	codes for boiler safety controls
K 15	insulation requirements for hydronic installations
K 16	dangers of system malfunction
K 17	limitations of materials

Sub-task

F-16.01 Sizes piping and components for hydronic systems.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	no	no	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-16.01.01	perform room-by-room heat loss and gain calculation if required
F-16.01.02	identify load requirements according to system being used, drawings and specifications
F-16.01.03	identify conventional and alternate fuels or energy sources such as oil, gas, wood, electrical, geothermal, solar thermal being used individually or in combination to meet requirements of heat generating system
F-16.01.04	select required heat generator and cooling equipment for load
F-16.01.05	determine pipe type and size according to friction loss, load and distribution requirements

F-16.01.06	determine pumps required according to drawings and specifications
F-16.01.07	calculate provision for expansion and apply to sizing expansion tank
F-16.01.08	select and position expansion joints such as piston, bellows and loop
F-16.01.09	select and position components and accessories such as strainers, and zone and isolation valves
F-16.01.10	calculate requirements for circuit balancing valves
F-16.01.11	ensure compatibility between multiple heating and cooling source systems

Sub-task

F-16.02 Installs piping for hydronic systems.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-16.02.01	determine routing according to drawings, specifications, site conditions and equipment location
F-16.02.02	use tools and equipment such as threading equipment, cutters and torches
F-16.02.03	install piping plumb, level, straight or graded
F-16.02.04	join materials such as copper, steel and stainless steel piping using methods such as threading, grooving and welding
F-16.02.05	join plastic piping using methods such as crimping, expansion, compression, and butt and socket fusion welding
F-16.02.06	install connections for draining and venting systems
F-16.02.07	install expansion loops and approved flexible connectors as required
F-16.02.08	label and stencil pipe for pipe identification
F-16.02.09	install flanges and union connection according to service requirements

Sub-task**F-16.03 Installs hydronic system components.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-16.03.01	use tools and equipment such as chain falls, wrenches and come-alongs
F-16.03.02	assemble and place components and accessories such as air scoops, flow switches, heat exchanger, pot feeders, expansion tanks and low-water cutoffs
F-16.03.03	assemble on or off site and install pipe and/or equipment supports and modular assemblies such as pump stations and manifold stations
F-16.03.04	establish optimum location for installation of diagnostic accessories such as thermometers, sensors and pressure gauges
F-16.03.05	connect components to hydronic system such as pumps and accessories according to specifications
F-16.03.06	verify proper spacing and operation of components
F-16.03.07	set up expansion tanks and charge if required
F-16.03.08	assemble and install proper support of pump such as brackets, stands and pads
F-16.03.09	assemble, place and secure pumps plumb and level
F-16.03.10	install flanges and union connection according to service requirements
F-16.03.11	verify proper operation of pump
F-16.03.12	lubricate pumps according to specifications before start-up if required

Task 17**Installs hydronic heating and cooling generating systems and equipment.**

Context Hydronic heating generating systems keep water at an elevated temperature for purposes such as perimeter heating, fan-coils, in-floor heating and domestic hot water.

Cooling generating systems are used to keep the water at a constant temperature for air conditioning.

Required Knowledge

K 1	types of boilers such as low mass, high mass, electric, fuel, condensing and non-condensing
K 2	hydronic cooling generating equipment such as chillers, fluid coolers and cooling towers
K 3	AHJ requirements
K 4	heat pumps
K 5	required clearances for venting and access
K 6	fuel source
K 7	basic safety codes for heating and cooling generating devices
K 8	limitations of materials

Sub-task**F-17.01 Installs hydronic heating generating systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-17.01.01	coordinate and set up installation of multiple heat source system
F-17.01.02	confirm heating generating system required according to drawings, AHJ and specifications
F-17.01.03	confirm location of equipment to be installed according to drawings, specifications and site conditions
F-17.01.04	create housekeeping pad for protection of equipment if required according to AHJ

F-17.01.05	use tools and equipment such as come-alongs, chain falls, forklifts and pallet jacks
F-17.01.06	level and secure equipment
F-17.01.07	install vibration isolation for generating equipment according to specifications
F-17.01.08	connect heating generating equipment to piping using methods such as threading, soldering and grooving
F-17.01.09	install connections for draining and venting systems to compensate for condensation

Sub-task

F-17.02 Installs hydronic cooling generating systems.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-17.02.01	confirm cooling generating system required according to drawings, AHJ and specifications
F-17.02.02	coordinate and set up installation of multiple cooling systems
F-17.02.03	confirm location of equipment to be installed according to drawings, specifications and site conditions
F-17.02.04	create housekeeping pad for protection of equipment if required according to AHJ
F-17.02.05	use tools and equipment such as come-alongs, chain falls, forklifts and pallet jacks
F-17.02.06	level and secure equipment
F-17.02.07	install vibration isolation for generating equipment according to specifications
F-17.02.08	connect cooling generating equipment to piping using methods such as threading, soldering and grooving
F-17.02.09	install connections for draining and venting systems to compensate for condensation

Task 18**Installs hydronic system controls and transfer units.****Context**

Hydronic system controls are used to monitor and control conditions such as water temperatures, pump speeds and outdoor air temperatures. They may be installed by plumbers and controlled from different areas, either on-site or in remote locations.

Transfer units are used to deliver or remove heat from a space via piping. Examples of transfer units are fan units, radiant panels, cast iron radiators and convectors. This is done to maintain a comfortable temperature.

Required Knowledge

K 1	hydronic system controls such as thermostats, supply sensors, pump sensors and outdoor temperature sensors
K 2	temperature settings such as boiler, slab, and supply and return
K 3	heating curves
K 4	types of hydronic transfer units such as radiant panels, heat exchangers, force flow units, unit heaters, in-floor heating and perimeter radiation
K 5	specified locations for transfer units
K 6	limitations of materials

Sub-task**F-18.01 Installs hydronic system controls.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-18.01.01	confirm system requirements for components and accessories to ensure optimum system operation
F-18.01.02	confirm the location of components and accessories
F-18.01.03	use tools and equipment such as wrenches, thermometers and multimeters
F-18.01.04	assemble and install components and accessories such as control modules, thermostats, supply sensors, pump sensors and outdoor temperature sensors
F-18.01.05	program, calibrate and adjust mechanical and electrical controls/modules and components to ensure desired set points

Sub-task**F-18.02 Installs hydronic transfer units.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-18.02.01	confirm type and location of hydronic transfer units according to drawings, specifications and site conditions
F-18.02.02	use tools and equipment such as drills, levels and measuring tapes
F-18.02.03	level and secure hydronic transfer units
F-18.02.04	install vibration isolation on hydronic transfer units according to specifications
F-18.02.05	position and connect hydronic transfer unit to piping using methods such as threading, soldering and grooving

BLOCK G

SPECIALIZED SYSTEMS

Trends

Residential fire protection system installations are increasing.

Rain water recovery and grey water systems are becoming much more common place in both commercial and residential applications. Rain water recovery systems are used to supplement irrigation systems and fixture supply water, and to limit the impact of rain water on municipal systems. Grey water systems are generally used to supplement fixture supply water.

Green roofs and living walls are emerging trends in commercial, institutional and industrial buildings. They may be used to provide added R value, utilize rain fall and aid in humidification.

Related Components

All components apply.

Tools and Equipment

See Appendix A.

Task 19

Installs piping and equipment for specialized systems.

Context

Natural gas, liquefied petroleum gas (LPG) and petroleum products are specialized piping installations. Plumbers install the piping from point of supply to the appliance isolation valve.

Plumbers install specialized piping and related equipment to provide medical gases in institutions such as hospitals, dental offices and clinics.

Residential irrigation systems provide water to lawns, gardens and flowerbeds. Commercial applications may include high volume installations for large areas such as farms, municipal parks and other public green spaces.

Ground source loops are essential components of a ground source heat pump system (geothermal). De-superheaters are components of the heat pump, used to provide supplementation to the domestic hot water supply.

Solar thermal systems are used to transfer heat for potable water and space heating supplementation as well as pool heating. Industrial installations also apply and may include low and high temperature applications.

Drain pipe heat recovery systems reclaim otherwise lost heat content from drains such as shower, sink and lavatory drains.

Compressed air systems provide filtered and dry compressed air for a variety of purposes.

Non-potable water systems would include green initiative items like grey water reuse and rainwater harvesting applications for irrigation and firefighting purposes. Plumbers would install collection and distribution piping and equipment for these systems.

Additional certification may be required in some jurisdictions to allow plumbers to install the piping for these systems.

Required Knowledge

- | | |
|-----|--|
| K 1 | hazards and characteristics of fuels such as natural gas, LPG and petroleum products |
| K 2 | AHJ requirements |
| K 3 | sizing requirements for pipe |
| K 4 | types of piping materials such as steel, plastic and copper |
| K 5 | pressure testing requirements |
| K 6 | gas service and meter location |
| K 7 | types of fuel system equipment installed by plumbers |
| K 8 | installation requirements and procedures for fuel system equipment |
| K 9 | equipment limitations |

- K 10 types of components such as natural gas regulators, tanks and cylinders
- K 11 equipment clearance and venting requirements
- K 12 medical gas pipe characteristics and requirements such as grade of pipe, and degreasing and capping requirements
- K 13 medical gas or medical vacuum systems
- K 14 certification requirements to join medical gas piping
- K 15 purging equipment, requirements and procedures for liquid and gaseous systems
- K 16 brazing material requirements and characteristics
- K 17 characteristics and operation of pneumatic pressurized systems
- K 18 dangers associated with cross-connection
- K 19 operations and controls of combination systems
- K 20 types of equipment such as vacuum pumps, air compressors, bulk systems and reserve systems
- K 21 accessories such as pressure reducing valves, pressure relief valves and dew-point sensors
- K 22 Diameter Index Safety System (DISS)
- K 23 types of irrigation systems
- K 24 trenching and borehole requirements
- K 25 types of irrigation equipment such as sprinkler heads, valve boxes, timers, pumps and solenoid valves and their applications
- K 26 layout of irrigation systems
- K 27 residential and commercial irrigation systems
- K 28 winterization considerations such as slope, drainage points and purge points
- K 29 identification of on-site piping to prevent hazardous conditions
- K 30 types of pipe and their approval for specific applications
- K 31 building penetration requirements
- K 32 potential environmental impact of fluids and materials
- K 33 solar equipment and components
- K 34 geothermal system components
- K 35 characteristics of mediums used for antifreeze
- K 36 limitations of materials

Sub-task**G-19.01 Installs piping for specialized systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

G-19.01.01	confirm materials required to install piping according to drawings, AHJ and specifications
G-19.01.02	confirm routing according to drawings, specifications, site conditions and equipment location
G-19.01.03	lay out and assemble pipe according to drawings, AHJ, specifications and site conditions
G-19.01.04	use tools and equipment such as threading equipment, cutters, torches and flaring tools
G-19.01.05	plumb and level or grade pipe as required
G-19.01.06	install approved piping components such as dirt and drip pockets, swing joints and flexible connectors according to system type and AHJ

Sub-task**G-19.02 Installs equipment for specialized systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

G-19.02.01	confirm materials required to install equipment and components according to drawings, AHJ and specifications
G-19.02.02	confirm location and installation sequence of equipment and components according to specifications
G-19.02.03	use tools and equipment such as wrenches, chain-falls, pressure gauges and come-alongs
G-19.02.04	place, level and secure equipment and components such as tanks, pumps, valve boxes, zone valves, sprinkler heads and backflow preventers
G-19.02.05	compensate for movement and vibration of equipment if required
G-19.02.06	verify type of fluid or gas being used and supply pressure

- G-19.02.07 connect piping to equipment and components using purging procedure if required
- G-19.02.08 identify and select proper outlet according to the DISS

Sub-task

G-19.03 Installs piping and equipment for non-potable systems.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

- G-19.03.01 confirm materials required to install piping, equipment and components according to drawings, AHJ and specifications
- G-19.03.02 confirm location and installation sequence of piping, equipment and components according to drawings, specifications and site conditions
- G-19.03.03 position and assemble pipe according to drawings, AHJ and specifications
- G-19.03.04 use tools and equipment such as wrenches, pressure gauges, threading equipment, cutters, torches, flaring tools and levels
- G-19.03.05 place, level and secure piping, equipment and components such as tanks, pumps, valves, sprinkler heads, and backflow preventers
- G-19.03.06 plumb and level or grade pipe as required
- G-19.03.07 compensate for movement and vibration of piping and equipment if required
- G-19.03.08 connect pipe to equipment and components
- G-19.03.09 install drain valves and vents as required
- G-19.03.10 set up filtration equipment according to system requirements
- G-19.03.11 confirm non-potable is labelled correctly after installation

Task 20**Installs fire protection systems. (NOT COMMON CORE)**

Context Fire protection systems help save lives and ensure minimal fire damage to structures. Jurisdictional regulations determine the scope of the work that plumbers can perform in installing fire protection systems.

Required Knowledge

- K 1 applicable codes such as the National Fire Protection Association (NFPA)
- K 2 rough-in requirements for piping
- K 3 limitations of materials
- K 4 wet and dry systems
- K 5 types of piping materials such as steel, plastic and copper
- K 6 pumps and their requirements
- K 7 cross-connection/backflow preventers
- K 8 components such as gauges, pressure switches, supervisory valves and flow alarm switches
- K 9 flow-through systems
- K 10 types of sprinklers such as concealed, sidewall, pendant and upright
- K 11 AHJ requirements and specifications regarding pressurized piping and vessels
- K 12 piping arrangements such as straight-line supply and loop
- K 13 components of air systems such as air dryers, flex-connectors, auto drains, pressure regulators and filters
- K 14 compressor operation
- K 15 types of compressors such as reciprocating and scroll
- K 16 safety devices such as relief valves and guards

Sub-task**G-20.01 Installs piping for standpipe systems. (NOT COMMON CORE)**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
no	no	no	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

G-20.01.01	confirm materials required to install piping according to drawings, AHJ and specifications
G-20.01.02	confirm routing according to drawings, specifications, site conditions and equipment location
G-20.01.03	use tools and equipment such as PEX pipe expander, threading equipment, cutters, torches and grooving equipment
G-20.01.04	install sprinkler heads for intended application
G-20.01.05	plumb and level standpipe system
G-20.01.06	identify pipe using methods such as painting and labelling according to AHJ, specifications and site requirements
G-20.01.07	position and assemble pipe according to drawings, AHJ, operational requirements and specifications
G-20.01.08	install drain valves as required

Sub-task**G-20.02 Installs equipment for standpipe systems. (NOT COMMON CORE)**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
no	no	no	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

G-20.02.01	confirm type, location and installation sequence of equipment and components such as fire pumps, jockey pumps, siamese connections, supervisory valves and backflow preventers according to drawings, AHJ, specifications and site conditions
G-20.02.02	use tools and equipment such as cutters, torches, threading equipment and groover
G-20.02.03	place, level and secure equipment and components such as fire hose cabinets, fire pumps and flow switches

G-20.02.04	connect standpipe system to pipe, equipment and accessories
G-20.02.05	compensate for movement and vibration of equipment if required

Sub-task

G-20.03 **Installs fire protection systems for single family dwellings. (NOT COMMON CORE)**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
no	no	no	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

G-20.03.01	confirm type, location and installation sequence of equipment
G-20.03.02	confirm components such as supervisory valves and backflow preventers according to drawings, AHJ, specifications and site conditions
G-20.03.03	use tools and equipment such as cutters, threading equipment and expansion tool
G-20.03.04	place, level and secure equipment and components
G-20.03.05	connect system to pipe, equipment and accessories
G-20.03.06	compensate for expansion and contraction of system if required

Sub-task

G-20.04 **Installs fire protection systems for industrial, commercial and institutional (ICI) buildings. (NOT COMMON CORE)**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
no	no	no	no	no	yes	no	no	no	yes	NV	NV	NV

Key Competencies

G-20.04.01	confirm type, location and installation sequence of equipment and components such as fire pumps, jockey pumps, siamese connections, supervisory valves and backflow preventers according to drawings, AHJ, specifications and site conditions
G-20.04.02	confirm materials required to install piping according to drawings, AHJ and specifications
G-20.04.03	confirm routing according to drawings, specifications, site conditions and equipment location

G-20.04.04	use tools and equipment such as threading equipment, cutters, torches and grooving equipment
G-20.04.05	install sprinkler heads for intended application
G-20.04.06	plumb and grade system as required
G-20.04.07	identify pipe using methods such as painting and labelling according to AHJ
G-20.04.08	position, assemble and connect pipe and equipment according to drawings, AHJ, operational requirements and specifications
G-20.04.09	compensate for movement and vibration of equipment if required

Task 21

Installs process piping systems.

Context Process piping allows for a wide variety of applications. These piping systems may convey materials or fluids for applications such as manufacturing or treatment processes. These systems are installed in locations ranging from small businesses to large factories.

Required Knowledge

K 1	piping materials such as copper, stainless steel, steel and plastic
K 2	joining methods such as soldering, flaring, welding, brazing and compression
K 3	rough-in requirements for piping
K 4	process piping system equipment such as boilers, heat exchangers, pumps and RO systems
K 5	types of process piping components such as pressure reducing valves, pressure relief valves and filters
K 6	minimum and maximum allowable pressures
K 7	AHJ requirements
K 8	system requirements such as isolation of equipment and cross-connection controls
K 9	limitations of materials

Sub-task**G-21.01 Installs piping for process piping systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

G-21.01.01	confirm the media to be conveyed through the pipe
G-21.01.02	confirm installation practices required to maintain integrity of piping systems according to specifications
G-21.01.03	confirm materials required to install piping according to drawings, AHJ and specifications
G-21.01.04	confirm routing according to drawings, specifications, site conditions and equipment location
G-21.01.05	use tools and equipment such as threading equipment, cutters, torches, grooving equipment and flaring tools
G-21.01.06	position and assemble piping according to drawings, AHJ and specifications
G-21.01.07	plumb, level and grade pipe as required
G-21.01.08	identify pipe using methods such as painting and labelling according to AHJ, specifications and site requirements

Sub-task**G-21.02 Installs process piping system equipment.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

G-21.02.01	confirm the media to be conveyed through the system
G-21.02.02	confirm type, location and installation sequence of equipment and accessories according to drawings, AHJ, specifications and site conditions
G-21.02.03	use tools and equipment such as wrenches, torches and threading equipment
G-21.02.04	position, assemble and connect pipe and equipment according to drawings, AHJ, operational requirements and specifications

BLOCK H

MAINTENANCE AND REPAIRS

Trends

Today's technology provides plumbers with an increasing variety of challenges. There is an increase in customer awareness and expectations, with a corresponding rise in the use of service programs and extended warranties. This requires plumbers to constantly upgrade their skills and training to perform necessary repairs.

Interaction between plumbers and owners is increasing. As a result, apprentices and journeypersons need to develop the skills to not only explain the problems but also discuss the solutions.

While many materials are no longer installed, there continues to be a requirement to maintain and repair these materials.

Related Components

All components apply.

Tools and Equipment

See Appendix A.

Task 22

Maintains systems and components.

Context

Plumbers monitor and maintain systems such as sewage treatment, hydronic, water treatment, potable and non-potable water, and heating/cooling systems.

Maintaining systems requires the plumber to recognize the necessity for scheduled maintenance and system monitoring.

Plumbers must be able to inspect systems, or modify an existing maintenance program. Plumbers also need the ability to return equipment to a working condition.

Required Knowledge

- | | |
|-----|-------------------------------------|
| K 1 | system design |
| K 2 | system operational sequence |
| K 3 | system components |
| K 4 | preventative maintenance programs |
| K 5 | AHJ requirements and specifications |

K 6	specialized tools such as refractometers, multimeters, drain augers, cameras, test strips and kits
K 7	past system performance
K 8	historic piping practices including materials, equipment and systems

Sub-task

H-22.01 Monitors system performance.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

H-22.01.01	monitor fluid levels on hot water and steam equipment to avoid a low-water situation
H-22.01.02	verify operation of components such as relief valves, sight glasses and controls to ensure that they will operate as required
H-22.01.03	read gauges such as temperature and pressure gauges on an ongoing basis
H-22.01.04	check pH levels on low pressure steam systems to ensure neutral levels
H-22.01.05	check cross-connection control devices to ensure that correct device is installed according to AHJ
H-22.01.06	record daily activities in log to document activities for future reference
H-22.01.07	use tools and equipment such as refractometers and pH meters

Sub-task

H-22.02 Performs maintenance.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

H-22.02.01	inspect equipment for conditions such as wear, noise, leaks and corrosion to determine repairs required
H-22.02.02	lubricate pumps and bearings using materials such as graphite, grease and oil to prevent wear of components as required
H-22.02.03	clean and change filters and strainers as required to prolong the life of the system and maintain adequate flow

H-22.02.04	adjust and tighten components such as flanges and packing glands on valves
H-22.02.05	check levels of fluids such as glycol, potassium permanganate and brine
H-22.02.06	check and adjust pressures as required to maintain system performance and to detect system problems
H-22.02.07	check fluid conditions such as pH levels, strength of glycol and quality of water
H-22.02.08	complete checklist to document status of current system and follow-up actions required
H-22.02.09	verify operation of temperature and pressure relief valves to ensure they will operate when required
H-22.02.10	test or arrange for testing of cross-connection control devices according to AHJ
H-22.02.11	perform scheduled maintenance of systems

Task 23

Troubleshoots systems and components.

Context Plumbers must be able to diagnose, repair and replace defective components in order to maintain proper operation of the systems. They also need to return equipment to service.

Required Knowledge

K 1	system design and operational sequence
K 2	systems such as plumbing, medical gas, fuel and pressure
K 3	system components such as fixtures, appliances, piping, pumps and equipment
K 4	historic piping practices including materials, equipment and systems
K 5	types of pipes, related materials and equipment
K 6	related troubleshooting documentation such as specifications and installation guides

Sub-task**H-23.01 Diagnoses plumbing-related systems and components.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

H-23.01.01	use tools and equipment such as ammeter, air monitor and multimeter to detect faults such as zone valve shorts, burnt out heating elements and pressure switches not working
H-23.01.02	interpret end user's information to assist in the diagnostic process
H-23.01.03	perform sensory inspection to detect plumbing system problems such as water leaks, fuel leaks, sewer gases and cracked pipe
H-23.01.04	perform systems check to analyze performance
H-23.01.05	check and adjust pressures as required to detect system problems
H-23.01.06	check levels of fluids such as potassium permanganate and brine
H-23.01.07	inspect equipment for conditions such as wear, noise, leaks and corrosion to determine repairs required

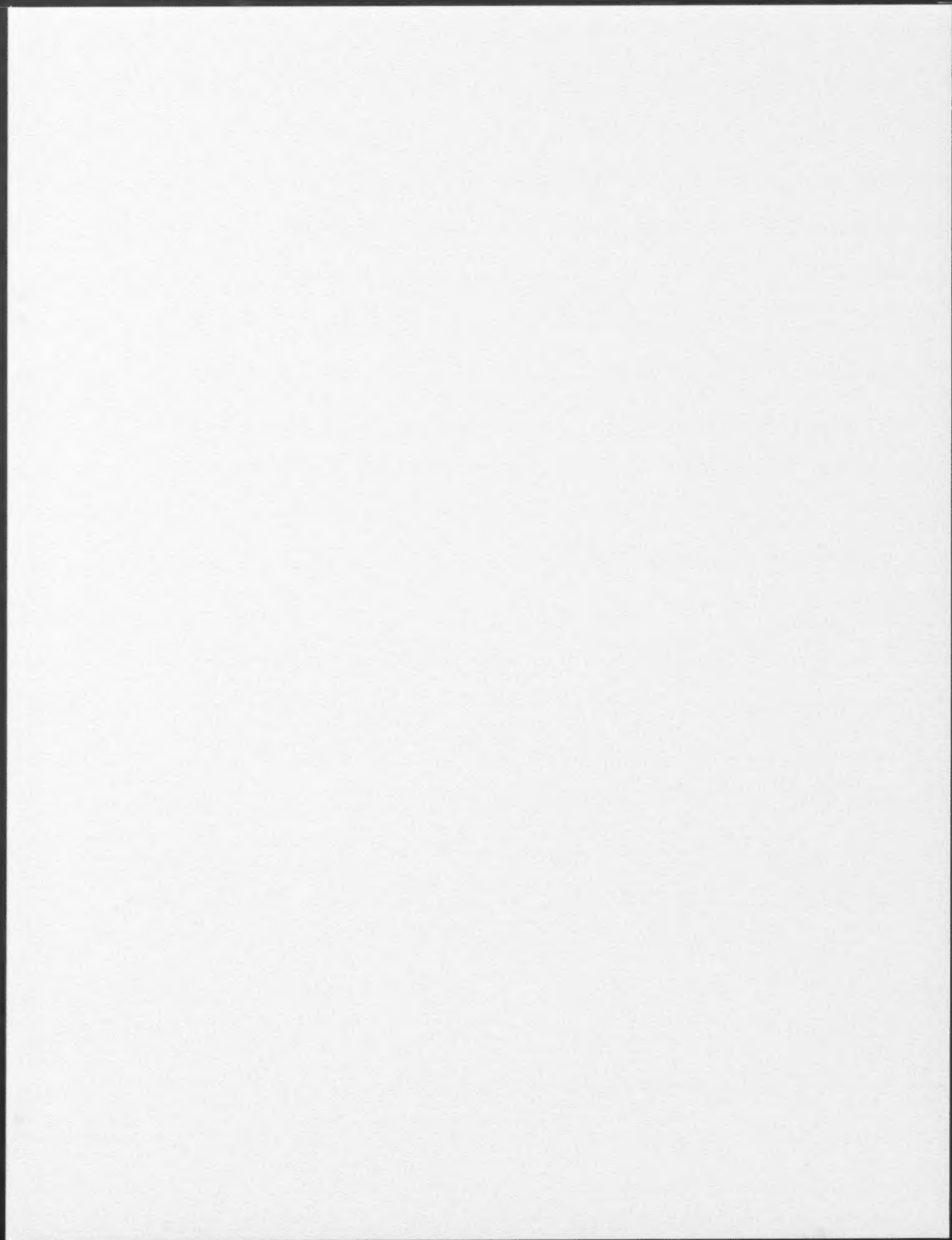
Sub-task**H-23.02 Repairs plumbing-related systems and components.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

H-23.02.01	determine whether components require replacement or repair based on factors such as cost, condition and availability of parts
H-23.02.02	determine required isolation of system
H-23.02.03	notify system owner of need to isolate and execute isolation
H-23.02.04	use tools and equipment required for repairs
H-23.02.05	replace components such as water heater elements, relief valves and zone valves
H-23.02.06	repair components such as piping, toilets, faucets and circulators
H-23.02.07	return system to service and verify correct system operation
H-23.02.08	complete required documentation, such as work orders, installation guides and warranty cards according to specifications and company policies

APPENDICES



APPENDIX A

TOOLS AND EQUIPMENT

Hand Tools

adjustable wrench
ball-peen hammer
basin wrench
bolt cutter
broom
caulking gun
chalk line
chisel
cistern pump (hand operated-diaphragm)
claw hammer
combination wrench
diaphragm pump (hand operated)
drywall saw
faucet seat wrench
file
flashlight
hacksaw
hand groover
hand saw
hand threader
hex keys (set)
hole saws
knife
level
locking pliers
pick
pipe wrenches

pliers (lineman, needle nose, water pump,
groove lock)
plumb bob
pry bars
punch
ratchet
reamer
rubber mallet
scratch awl
screwdrivers (complete set)
shovel
sledgehammer
socket set (imperial and metric)
spud wrench
square
strap wrench
striker
stud finder
stud punch
swage
T square
tap and die sets
tin snips (set)
torque wrench
transfer pump (hand-operated)
tri square
utility brushes
wire brushes

Power Tools

air compressor and accessories
band saw
bench grinder
booster pump
chop saw
circular saw
concrete cutter
coring machines
cryogenic equipment
die grinder

drain cleaning equipment
drill press
drills
generator
heat gun
heat lamp
impact wrench
inspection cameras
mini grinder
portable band saw (hack saw)

Power Tools (continued)

powder-actuated tools
power hole saw
reciprocating saw
rotary hammer

steamer
task lighting equipment
transfer pump (electric and pneumatic)

Hoisting, Rigging and Access Tools and Equipment

beam trolleys
block and tackles
boom truck
bridles
chain block hoist (endless chain)
come-along and grip hoist
crane
dolly
fork lift
ladders
lifting eyes
man/material lift (manual and power)
pallet jack

rope/cable
scaffolding
scissor lifts
shackles (varying sizes)
skid steer loader
slings and chokers
snatch blocks
spreader bar
stair cart
telescopic forklift
tuggers (power)
winches
wire rope or nylon (synthetic)

Personal Protective and Safety Equipment

air quality tester
arc flash protection
barricades and caution tape
confined space equipment
eye wash kit
face shield
fire blanket
fire extinguisher
fire resistant clothing
first aid kit
gloves (industrial, rubber)
ground fault circuit interrupter

hard hat
hearing protection
kneepads
lock-out/tag out devices
reflective vests
respiratory mask
rubber boots (CSA)
safety boots (CSA)
safety glasses/goggles (CSA)
safety harness, lanyard and life line (CSA)
tripod

Pipe Cutting and Joining Equipment

copper tube cutter	pipe groover
crimpers	pipe reamer
files (set)	pipe roller
flaring tools	pipe stand
fusion tools	pipe threader
gas cylinders, and soldering and brazing equipment	pipe vise
gas powered cut-off	plastic tube cutters (set)
grooving machine	power vise
hand-operated oiler	propane torch
hot air gun (welder)	ratchet cutter
hot tap equipment	snap cutter
hydraulic pipe cutter	specialized assembly tools and equipment
mechanical crimper	T-extracting tool
PEX crimper	tube bender
PEX pipe expander (manual and power)	tube cutter
pipe cutter	welding equipment

Testing, Measuring and Communication Equipment

builder's level	infrared thermometer
calculator	laser layout tools
calliper	manometer
communication devices	markers
computer	measuring tape
crimp gauge	micrometer
differential pressure gauge and sight tube	multimeter
drafting equipment	refractometer
electronic leak detector	scale rule
gauges	scanning equipment
GPS	test strips and kits
groove depth tape	thermal imager
hand pump and accessories (bicycle pump)	thermometer
hydrostatic pump and gauge (manual and power)	two way radios

APPENDIX B

GLOSSARY

appliance	piece of equipment which may require connection to a plumbing system
Authority Having Jurisdiction (AHJ)	includes all applicable codes, jurisdictional regulations, National Plumbing Code (NPC)
backflow preventer	device that prevents backflow
backwater valve	check valve designed for use in a gravity drainage system
branch (potable water)	any pipe connecting to a potable water main and ending at another branch, riser or fixture supply pipe
check valve	valve that permits flow in only one direction
circuit balancing valve	valve designed for flow regulation that can be set to design parameters
cleanout	access provided in drainage and venting systems to provide for cleaning and inspection services
components	parts of the system that are required for the operation of the piping and equipment
controls	component that adjusts, alters and regulates the operation of system devices and equipment
cross-connection	a connection between a potable water source to a non-potable water source
developed length	length along the centre line of the pipe and fitting
Diameter Index Safety System (DISS)	index system used for medical gases which defines the properties of the access points (diameter and configuration) allowing only specific connection devices to connect to corresponding gas access point
dielectric protection	a method isolating dissimilar metals to prevent electrolysis (ion transfer)
dirt and drip pocket	piping configuration to allow collection of dirt or condensation

drainage system	assembly of pipes, fittings, fixtures, traps and appurtenances that is used to convey sewage, clear-water waste or storm water to a public sewer or a private sewage disposal system, but does not include subsoil drainage pipes
drive point (screened)	tapered screened point at the end of a pipe used in a pressure system that is driven into the ground and placed at the bottom of a shallow well which acts as a casing and screens sand
embedded components	components of a plumbing system that are encased in concrete or other materials
expansion tank	device used to accept expansion of water in a closed system
fire stopping	construction assembly that acts as a barrier against the spread of fire and smoke
fixture	receptacle, appliance, apparatus or other device that discharges sewage or clear-water waste, includes a floor drain
fixture unit (drainage systems)	unit of measure based on the rate of discharge, time of operation and frequency of use of a fixture that expresses the hydraulic load that is imposed by that fixture on the drainage system
fixture unit (water distribution systems)	unit of measure based on the rate of supply, time of operation and frequency of use of a fixture or outlet that expresses the hydraulic load that is imposed by that fixture or outlet on the water supply system
flashing	component made of rubber, sheet metal or lead used to seal around exterior pipe penetrations
flex-connector	device used to isolate vibration and allow for expansion and movement of appliances, equipment and piping
head pressure	pressure developed by an increase in elevation
heat tracing	an electrical, hydronic or steam system that prevents the freezing of piping
home run	the run of pipe from the manifold to the water meter
hydronic system	a heating or cooling system which uses various types of fuels to heat or cool water which is then distributed through pipes to emitters located in various locations

interceptor	receptacle that is installed to prevent oil, grease, sand or other materials from passing into a drainage system
offset	a piping that connects the ends of two pipes that are parallel or perpendicular
pipe	includes all types of tube, tubing and pipe
pitless adaptor	fitting that allows the connection and removal of a pump without the use of tools or entering a confined space
plumbing system	drainage system, a venting system and a water system or parts thereof
potable	safe for human consumption
purge, to	to pass inert gas inside of pipe to prevent oxidation during brazing operations
roof drain	fitting or device that is installed in the roof to permit storm water to discharge into a leader
rough-in	placement of pipes in order to allow for final installation of fixtures and equipment
sanitary sewer	sewer that conducts sewage
sensory inspection	inspection using one or more of the following: sight, taste, touch, smell, auditory
sewage	any liquid water other than clear-water waste or storm water
sleeve	a component used to create a penetration through walls, floors and ceilings prior to the installation of piping
sounding	a method of detecting cracks in cast iron pipe and fitting
specifications	includes manufacturers's specifications, ANSI, engineers' requirements as well as all other applicable standards
storm sewer	sewer that conveys storm water
swing joint	piping arrangement to allow for movement of appliance without putting strain on piping
tempered water valve	a valve or a device that mixes hot and cold water to a predetermined temperature

thrust blocks	a formed concrete block used to prevent movement of a fitting at a change of direction in a buried piping system
torque arrestor	device installed on a pipe in a well casing which prevents the pipe from spinning
trap	fitting or device that is designed to hold a liquid seal that will prevent the passage of gas but will not materially affect the flow of a liquid
tube	measured by inside diameter (ID)
tubing	measured by outside diameter (OD) and wall thickness
venting system	assembly of pipes and fittings that connects a drainage system with outside air for circulation of air and the protection of trap seals in the drainage system
water distribution system	assembly of pipes, fittings, valves and appurtenances that conveys water from the water service pipe or private water supply system to water supply outlets, fixtures, appliances and devices
water heater	device for heating water for plumbing services
water system	private water supply system, a water service pipe, a water distribution system or parts thereof

APPENDIX C

ACRONYMS

ACR	air conditioning and refrigeration (tubing)
AHJ	Authority Having Jurisdiction
BIM	Building Information Modelling
BTU	British Thermal Unit
CAD/CAM	computer-aided design and manufacturing
CSA	Canadian Standards Association
DISS	Diameter Index Safety System
DWV	drain, waste and vent
G	gas (tubing)
GP	general purpose (tubing)
GPS	global positioning system
OH&S	Occupational Health and Safety
ICI	industrial, commercial and institutional
ID	inside diameter
LEED	Leadership in Energy and Environmental Design
LPG	liquefied petroleum gas
MSDS	Material Safety Data Sheets
NFPA	National Fire Protection Association
NPC	National Plumbing Code
OD	outside diameter
PLC	programmable logic control
PPE	personal protective equipment
RO	reverse osmosis
TDG	transportation of dangerous goods
TSP	trap seal primers
UV	ultraviolet
VOC	volatile organic compounds
WHMIS	Workplace Hazardous Materials Information System
WOG	water, oil and gas

APPENDIX D**BLOCK AND TASK WEIGHTING****BLOCK A OCCUPATIONAL SKILLS**

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	National Average
%	10	9	10	11	20	5	14	5	15	10	NV	NV	NV	11%

Task 1 Performs safety-related functions.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	25	40	25	21	25	20	28	30	30	15	NV	NV	NV	26%

Task 2 Uses and maintains tools and equipment.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	25	20	30	24	15	20	28	20	20	15	NV	NV	NV	22%

Task 3 Organizes work.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	25	20	25	25	35	20	16	30	25	20	NV	NV	NV	24%

Task 4 Performs routine trade activities.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	25	20	20	30	25	40	28	20	25	50	NV	NV	NV	28%

BLOCK B PIPING PREPARATION AND ASSEMBLY

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	National Average
%	15	13	15	13	16	11	14	10	15	10	NV	NV	NV	13%

Task 5 Prepares pipe.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	50	60	50	34	50	34	50	40	20	40	NV	NV	NV	43%

Task 6 Joins tube, tubing, pipe and fittings.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	50	40	50	66	50	66	50	60	80	60	NV	NV	NV	57%

BLOCK C DRAINAGE, WASTE, VENTS AND SEWAGE TREATMENT SYSTEMS

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	National Average
%	20	20	30	20	16	30	14	30	20	19	NV	NV	NV	22%

Task 7 Installs sewers.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	20	25	20	15	10	10	10	15	15	15	NV	NV	NV	16%

Task 8 Installs sewage treatment systems.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	10	25	20	11	0	10	40	15	0	15	NV	NV	NV	15%

Task 9 Installs rough-in for interior drainage, waste and vent (DWV) systems.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	70	50	60	74	90	80	50	70	85	70	NV	NV	NV	69%

BLOCK D WATER SERVICE AND DISTRIBUTION

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	National Average
%	15	15	10	15	16	15	14	15	10	18	NV	NV	NV	14%

Task 10 Installs water services.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	20	25	50	24	25	10	33	15	5	30	NV	NV	NV	24%

Task 11 Installs potable water distribution systems.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	60	50	30	52	55	75	33	70	75	50	NV	NV	NV	55%

Task 12 Installs pressure systems.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	20	25	20	24	20	15	34	15	20	20	NV	NV	NV	21%

BLOCK E FIXTURES, APPLIANCES AND WATER TREATMENT SYSTEMS

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	National Average
%	10	12	10	16	4	11	14	10	15	10	NV	NV	NV	11%

Task 13 Installs plumbing fixtures and appliances.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	70	60	60	78	100	80	70	70	90	80	NV	NV	NV	76%

Task 14 Installs water treatment systems.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	30	40	40	22	0	20	30	30	10	20	NV	NV	NV	24%

BLOCK F LOW PRESSURE STEAM AND HYDRONIC HEATING AND COOLING SYSTEMS

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	National Average
%	10	9	10	10	0	10	10	20	5	13	NV	NV	NV	10%

Task 15 Installs low pressure steam systems.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	15	0	25	16	0	10	10	10	5	10	NV	NV	NV	11%

Task 16 Installs hydronic heating and cooling piping systems.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	35	30	25	33	0	30	35	20	30	20	NV	NV	NV	29%

Task 17 Installs hydronic heating and cooling generating systems and equipment.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	35	35	25	28	0	40	35	50	35	20	NV	NV	NV	34%

Task 18 Installs hydronic system controls and transfer units.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	15	35	25	23	0	20	20	20	30	50	NV	NV	NV	26%

BLOCK G SPECIALIZED SYSTEMS

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	National Average
%	10	10	5	5	16	8	8	5	5	10	NV	NV	NV	8%

Task 19 Installs piping and equipment for specialized systems.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	60	50	50	37	30	40	55	60	60	60	NV	NV	NV	55%

Task 20 Installs fire protection systems. (NOT COMMON CORE)

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	0	0	0	22	0	20	5	10	15	20	NV	NV	NV	0%

Task 21 Installs process piping systems.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	40	50	50	41	70	40	40	30	25	20	NV	NV	NV	45%

BLOCK H MAINTENANCE AND REPAIRS

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	National Average
%	10	12	10	10	12	10	12	5	15	10	NV	NV	NV	11%

Task 22 Maintains systems and components.

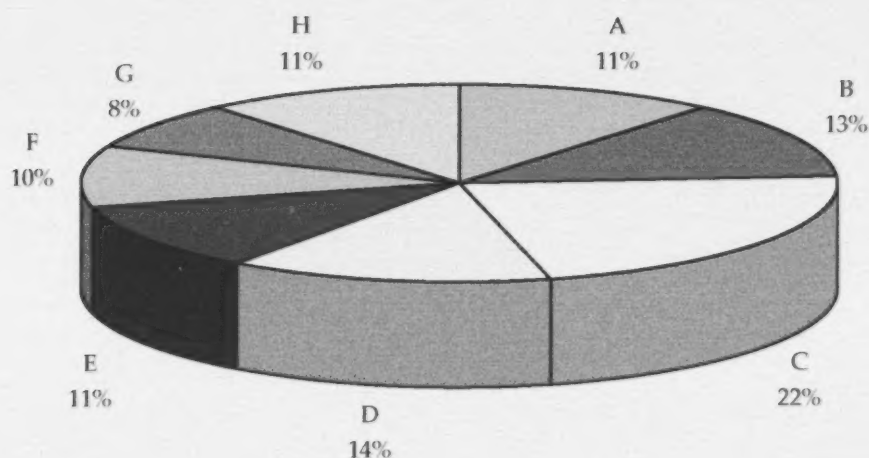
	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	50	60	50	46	50	50	50	50	40	40	NV	NV	NV	49%

Task 23 Troubleshoots systems and components.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	50	40	50	54	50	50	50	50	60	60	NV	NV	NV	51%

APPENDIX E

PIE CHART*



TITLES OF BLOCKS

BLOCK A	OCCUPATIONAL SKILLS	BLOCK E	FIXTURES, APPLIANCES AND WATER TREATMENT SYSTEMS
BLOCK B	PIPING PREPARATION AND ASSEMBLY	BLOCK F	LOW PRESSURE STEAM AND HYDRONIC HEATING AND COOLING SYSTEMS
BLOCK C	DRAINAGE, WASTE, VENTS AND SEWAGE TREATMENT SYSTEMS	BLOCK G	SPECIALIZED SYSTEMS
BLOCK D	WATER SERVICE AND DISTRIBUTION	BLOCK H	MAINTENANCE AND REPAIRS

*Average percentage of the total number of questions on an interprovincial examination, assigned to assess each block of the analysis, as derived from the collective input from workers within the occupation from all areas of Canada. Interprovincial examinations typically have from 100 to 150 multiple-choice questions.

APPENDIX F

TASK PROFILE CHART – Plumber

BLOCKS	TASKS	SUB-TASKS			
A - OCCUPATIONAL SKILLS	1. Performs safety-related functions.	1.01 Maintains safe work environment.	1.02 Uses personal protective equipment (PPE) and safety equipment.	1.03 Handles hazardous materials.	1.04 Performs lock-out and tag-out procedures.
	2. Uses and maintains tools and equipment.	2.01 Maintains tools and equipment.	2.02 Uses access equipment.	2.03 Uses rigging, hoisting and lifting equipment.	
	3. Organizes work.	3.01 Organizes project tasks and procedures.	3.02 Organizes materials and supplies.		
	4. Performs routine trade activities.	4.01 Performs piping system layout.	4.02 Calculates pipe length.	4.03 Calculates piping offsets.	4.04 Installs piping with adequate support.
B - PIPING PREPARATION AND ASSEMBLY		4.05 Installs sleeves.	4.06 Tests piping and plumbing systems.	4.07 Commissions systems.	4.08 Protects piping systems, equipment and structure from damage.
		4.09 Coordinates excavation and backfilling of trenches.	4.10 Installs fire stopping systems.		
	5. Prepares pipe.	5.01 Inspects tube, tubing, pipe and fittings before installation.	5.02 Cuts tube, tubing and pipe.	5.03 Bends tube, tubing and pipe.	
	6. Joins tube, tubing, pipe and fittings.	6.01 Joins copper pipe.	6.02 Joins plastic pipe.	6.03 Joins steel pipe.	6.04 Joins cast iron pipe.
		6.05 Joins specialized pipe.			

BLOCKS	TASKS	SUB-TASKS			
C - DRAINAGE, WASTE, VENTS AND SEWAGE TREATMENT SYSTEMS	7. Installs sewers.	7.01 Sizes pipe for sewers.	7.02 Installs manholes and catch basins.	7.03 Installs piping for sewers.	
	8. Installs sewage treatment systems.	8.01 Plans installation of sewage treatment systems.	8.02 Installs sewage treatment system components.		
	9. Installs rough-in for interior drainage, waste and vent (DWV) systems.	9.01 Sizes pipe for interior drainage, waste and vent (DWV) systems.	9.02 Installs underground piping and components for interior drainage, waste and vent (DWV) systems.	9.03 Installs piping and components for interior drainage, waste and vent (DWV) systems above-ground.	
D - WATER SERVICE AND DISTRIBUTION	10. Installs water services.	10.01 Sizes pipe for water services.	10.02 Installs piping for water services.	10.03 Installs water service equipment.	
	11. Installs potable water distribution systems.	11.01 Sizes piping and equipment for potable water distribution systems.	11.02 Installs piping for potable water distribution systems.	11.03 Installs potable water distribution equipment.	11.04 Installs cross-connection control devices.
	12. Installs pressure systems.	12.01 Sizes pressure systems.	12.02 Installs piping for pressure systems.	12.03 Installs equipment and components for pressure systems.	
E - FIXTURES, APPLIANCES AND WATER TREATMENT SYSTEMS	13. Installs plumbing fixtures and appliances.	13.01 Installs fixture supports.	13.02 Installs plumbing fixtures.	13.03 Installs plumbing appliances.	
	14. Installs water treatment systems.	14.01 Sizes water treatment equipment.	14.02 Installs water treatment equipment.		

BLOCKS	TASKS	SUB-TASKS			
F - LOW PRESSURE STEAM AND HYDRONIC HEATING AND COOLING SYSTEMS	15. Installs low pressure steam systems.	15.01 Sizes piping and components for low pressure steam systems.	15.02 Installs piping and components for low pressure steam systems.		
	16. Installs hydronic heating and cooling piping systems.	16.01 Sizes piping and components for hydronic systems.	16.02 Installs piping for hydronic systems.	16.03 Installs hydronic system components.	
	17. Installs hydronic heating and cooling generating systems and equipment.	17.01 Installs hydronic heating generating systems.	17.02 Installs hydronic cooling generating systems.		
	18. Installs hydronic system controls and transfer units.	18.01 Installs hydronic system controls.	18.02 Installs hydronic transfer units.		
G - SPECIALIZED SYSTEMS	19. Installs piping and equipment for specialized systems.	19.01 Installs piping for specialized systems.	19.02 Installs equipment for specialized systems.	19.03 Installs piping and equipment for non-potable systems.	
	20. Installs fire protection systems. (NOT COMMON CORE)	20.01 Installs piping for standpipe systems. (NOT COMMON CORE)	20.02 Installs equipment for standpipe systems. (NOT COMMON CORE)	20.03 Installs fire protection systems for single family dwellings. (NOT COMMON CORE)	20.04 Installs fire protection systems for industrial, commercial and institutional (ICI) buildings. (NOT COMMON CORE)
	21. Installs process piping systems.	21.01 Installs piping for process piping systems.	21.02 Installs process piping system equipment.		
H - MAINTENANCE AND REPAIRS	22. Maintains systems and components.	22.01 Monitors system performance.	22.02 Performs maintenance.		
	23. Troubleshoots systems and components.	23.01 Diagnoses plumbing-related systems and components.	23.02 Repairs plumbing-related systems and components.		